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**EFFECT OF COMPUTER-ASSISTED FEEDBACK STRUCTURES ON
ACHIEVEMENT OF SELECTED DRAFTING CONCEPTS IN THE UNIVERSITY
CLASSROOM SETTING**

Iowa State University

Ph.D. 1986

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**Effect of computer-assisted feedback structures
on achievement of selected drafting concepts
in the university classroom setting**

by


Ronald Casper Woolsey

**A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY**

Major: Industrial Education and Technology

Approved:

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1986

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CHAPTER 1. INTRODUCTION

The drafting and design industry requires of its professionals the ability to respond to increasing changes in product and tool design and to be able to communicate those changes quickly and accurately. With the onset of new technologies, the educator is required to cover more subject matter than ever before.

The development of computer-aided design systems has required the drafting instructor to teach traditional drafting conventions as well as computer-aided design fundamentals. Methods for introducing these fundamentals need to be examined and modified to include new technologies without sacrificing the integrity and effectiveness of the current curriculums.

Based on this need, computers are being used more and more in the classroom. New ways of using the computer must then be explored. Dahl (1984) examined student achievement of selected concepts in freshmen engineering using two different computer-assisted instruction (CAI) strategies, drill and practice and simulation. Based on the findings further exploration of the effect of CAI on spatial visualization was recommended.

Forman (1983) identified several questions that

educators and administrators were facing. Research into the most effective CAI strategies and type of feedback were first on the list of areas of needed research. The need for consistent guidelines and/or strategies for program development was also cited.

Statement of the Problem

The problem was designed to investigate the effect of computer-assisted feedback structures on achievement of selected drafting concepts in the university classroom setting. Three methods of instruction were examined in the study including: (1) traditional lecture/laboratory instruction (Control Group); (2) traditional with CAI utilizing delayed feedback (Treatment D); and (3) traditional with CAI utilizing immediate feedback (Treatment I).

Hypotheses

The following independent variables, subject grade point average, general drafting ability, visual-haptic aptitude and method of instruction were investigated to determine the effect on the dependent variable achievement. The following is the general linear model which includes the main effects or independent variables and the second order interactions of treatment group by main effects:

$$\begin{aligned}\hat{Y} = & B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_1X_4 \\ & + B_7X_1X_5 + B_8X_2X_4 + B_9X_2X_5 + B_{10}X_3X_4 \\ & + B_{11}X_3X_5 + B_0\end{aligned}$$

\hat{Y} = General Drafting Posttest

X_1 = Grade Point Average

X_2 = General Drafting Pretest

X_3 = Visual Aptitude MAT 8 & 9

X_4 = 1 If Treatment Group 2, 0 otherwise

X_5 = -1 If Treatment Group 3, 0 otherwise

The following null-hypotheses were posed to test the tenability of the problem:

1. There will be no significant difference of scores on the achievement posttest between the control group, the treatment group receiving the delayed feedback CAI and the treatment group receiving the immediate feedback CAI.

$$H_{01}: B_j = 0 \text{ for } j = 4, 5$$

2. There will be no significant interaction between the treatments and grade point average in relation to a subject's posttest score.

$$H_{02}: B_j = 0 \text{ for } j = 6, 7$$

3. There will be no significant interaction between the treatments and pretest scores in relation

to a subject's score on the posttest.

$$H_{03}: B_j = 0 \text{ for } j = 8, 9$$

4. There will be no significant interaction between the treatments and visual-haptic aptitude as measured by the Multiple Aptitude Test 8 & 9 in relation to a subject's posttest score.

$$H_{04}: B_j = 0 \text{ for } j = 10, 11$$

Purposes of the Study

The researcher established the following purposes for completing the study:

1. To measure the effects of two methods of reinforcement using computer-assisted instruction on achievement of selected fundamental drafting concepts.

2. To increase the subjects' understanding of the procedures involved in visualizing pictorial projections from a given orthographic projection and vise-versa.

3. To investigate and present a method for incorporating computer-assisted instruction into basic drafting courses.

4. To develop an interactive program for enhancing visual cognition of parallel, oblique, and curved surfaces in orthographic and pictorial projections for IBM-PC and compatible microcomputers.

Assumptions

This study was based on the following assumptions:

1. Students enrolled in Design Drafting 101 during the Fall semester, 1985, at Indiana State University were representative of students enrolled in basic drafting courses.

2. The computer reinforced instructional programs provided drill and practice for the orthographic and pictorial concepts being taught in Design Drafting 101.

3. Students in the treatment groups completed the computer-assisted instructional programs as assigned.

4. Method of reinforcement should be taken into consideration when developing computer-assisted instructional programs.

Delimitations

The following delimitations which might affect the study were identified:

1. Subjects in the treatment groups were required to complete only sixteen of twenty traditional (paper/pencil) assignments due to the time necessary to complete the computer-assisted instructional programs.

2. Subjects may have possessed random degrees of ability depending on individual differences in

background experiences.

3. The computer-assisted instructional programs were designed to be completed on an individual basis; some error may exist if subjects received assistance.

4. The concepts being measured represented only a portion of the total course content for Design Drafting 101.

5. Subjects in all groups were aware that they were participating in the experiment which may have created some interaction.

6. Actual treatments were administered over a four week period representing only one-fourth of the total course.

Definition of Terms

The terms defined below are provided in an attempt to ensure a common understanding of terminology in this study.

1. Computer Assisted Instruction (CAI) - The utilization of a computer in the educational process to assist in the acquisition of material to be learned (Dahl, 1984).

2. Drill and practice CAI - A computer-assisted instruction strategy that consists of a series of exercises or problems which route the student in a way

which optimizes performance (Kearsley, 1977).

3. Orthographic Projection - A method of representing three dimensional objects through the use of views which are projected perpendicularly onto planes of projection with parallel projectors (Earle, 1973).

4. Pictorial Projection - A drawing that shows three faces of an object in one view (Giesecke, 1974).

5. Visualization - This refers to the ability to form a mental image of points, lines, planes and objects as they occupy positions in space and their relationship to one another.

6. Visual-Haptic Aptitude - A method of classifying on a continuum an individual's ability to visually perceive a three dimensional object in a two dimensional plane (Lowenfield, 1939).

7. Traditional Instructional Method - a lecture demonstration followed by a paper and pencil performance laboratory experience.

8. Drawing Plate - refers to an individual drawing exercise in a printed workbook.

9. Random Seed - an integer number used by a computer program for initializing a variable value so true randomization may occur.

CHAPTER 2. REVIEW OF RELATED LITERATURE

The following review of literature is divided into three parts as they relate to the problem that was studied. The first part reviews research and theories of visual perception and visual-haptic aptitude. The second section examines current trends and research of instructional methods of selected drafting techniques. The final element of this review focuses on computer-assisted instruction in education.

Visual Perception and Visual-Haptic Aptitude

Achievement of orthographic and pictorial drafting concepts may be dependent on an individual's visual perception or visual-haptic aptitude. A review of what visual perception or visual-haptic aptitude involves was needed for the researcher's background.

Gibson (1968) felt that perceptual learning has been overlooked as it relates to education. This is representative of the viewpoint that has emerged within the last twenty years. During this time, the need for investigation or research of visual perception and its relationship to learning has increased.

Deutsch (1969) explains that education takes place through the perceptual processes. Development of these processes should be paramount in the psychological and

cognitive development of children. Research in the field of visual perception is, therefore a necessity. This is also supported by Piagetian theory which places sensory, sensory-motor, and perceptual experiences as the building blocks of intelligence.

Frostig (1972) has been a leader in the development of materials which provide visual perception training. In order to develop visual perceptual skills, the learner must first listen to the instruction then follow through with the activity. This also fosters learning in the areas of receptive language, sequential memory, and auditory-motor association.

Behrmann (1972) felt it necessary to distinguish between sight and vision in developing a rationale for perceptual training. Sight is merely the ability of the eye to place the image of an object onto the retina. Vision is the ability to use the information obtained through sight and involves sensory, psychological, and motor functions. Behrmann further stated that a person is born with sight but vision is a learned process.

Dwyer (1972) investigated the affect of using differing visual illustrations to teach science

concepts to college freshmen. The study researched (1) the effectiveness of three types of visual illustrations used to complement oral instruction; (2) whether or not realism was an appropriate and reliable predictor of visual learning when the illustrations were used to complement instructions; and (3) if there was a specific visual learning continuum which was most effective for achieving specific types of learning objectives.

Three different methods of illustration were used, linear representation, shaded detailed drawings, and realistic photographic representation. Dwyer (1972) found that (1) the linear representations and the shaded detailed drawings were more effective than the photographic representations as an aid to learning; (2) a realism continuum is not a reliable predictor of learning effectiveness when applied to visual illustrations and oral instructions; (3) differing continuums of learning effectiveness were found for each educational objective measured; and (4) increased size of the visual image used will not necessarily improve achievement.

Smith (1964) stated that students and psychologist have difficulty distinguishing between spatial

relations and orientation. In studying thirteen to fourteen year old learners, spatial ability was associated with abstract, conceptual, and mathematical thinking. The ability to comprehend the arrangement of elements within a visual stimulus pattern was affected by the variables of spatial relations and orientation. Visualization is a factor involving mental manipulation of an object in a sequence of movement.

Giesecke, Mitchell, Spencer and Hill (1975) believed spatial visualization was a major factor in learning orthographic projection principles. Further investigation of perceptual learning and its relationship to spatial visualization has been overlooked in laboratories and research.

A discussion of visual-haptic aptitudes is also appropriate when considering individual differences as they relate to perception.

Lowenfield (1939) defined visual aptitude as dependence on optical perceptions for an individual to make observations about the environment. A haptic individual would tend to rely on touch or kinesthetic sensations in order to perceive the environment. Individuals would be classified within the visual-haptic continuum based on the extent to which they rely

on visual or haptic perceptions.

Baird (1973) used college students with normal vision to investigate ability of the haptic and visual perceptual systems to discriminate and identify solid shapes which varied in three dimensions. Baird found visual systems to be superior to haptic systems in acquiring accurate information.

Concannon (1970) concluded from a review of research that there is interest in haptic learning. An investigation was made of Piaget's and Montessori's study of the development of haptic abilities of preschool subjects involved in both individual and group instruction of tactual exploration. Those subjects who had been involved in learning through haptic perception differed significantly from those who had not.

The relative effectiveness of scale models and pictorial drawings in learning selected orthographic projection principles was examined by Bjorkquist (1966). Sixth grade boys used either scale models, pictorial drawings, or no visual aids in learning selected orthographic projection principles. Bjorkquist concluded that pictorial drawings were more effective than scale models or no visual aids in

learning the principles examined.

Glazener (1958) studied the achievement of junior high school students in selected units of beginning mechanical drawing. Two and three-dimensional drawings were presented in addition to traditional teaching methods for the treatment group. Glazener's findings supported the hypothesis. In his conclusions, the following recommendations were made: (1) similar studies are needed involving a higher level of training; (2) additional research should be conducted using new or different visual aids; and (3) all levels of teaching and teacher preparation should be encouraged to develop and use visual aids.

Method of Instruction

The method in which subject matter is presented to the learner has also been examined in this review. A variety of methods for teaching drafting concepts have been researched in the past two decades. Before the advent of computers, research focused on such concepts as individualized instruction, programmed instruction, self-instruction, use of visual aids, and order of presentation when examining method of instruction.

Coburn (1977) made a comparison of two methods of teaching selected units in technical drawing.

Programmed instruction with supervision was found to be equally effective as lecture-demonstration instruction when measuring cognition of technical drafting concepts. Retention of subject matter also showed a significantly positive correlation.

Fifty-two senior high school students were used to examine the differences between individualized and lecture/laboratory approach to teaching basic drafting (Ryan, 1976). Attitudes toward the type of instruction were also explored. Ryan's conclusions stated that students were not adversely affected by an individualized approach. Student attitude when comparing methods of instruction was found to be equally positive.

Clark (1971) presented the principles of orthographic projections with differences only in the accompanying written information. Subjects were administered the Successive Perception Test I in order to establish their visual-haptic aptitude. Each treatment group contained a random assignment of subjects from each level of aptitude. Presentation of orthographic projections was based on prerequisite principles and visualization. Subjects that received the prerequisite principles method of instruction

scored significantly higher on cognition of the final task in the Clark (1971) study. It was also concluded that subjects learning through prerequisite principles required fewer units to reach the final task.

Franchak (1971) investigated the effect of identification of relevant and irrelevant cues on learning multiview orthographic projection concepts. The following three instructional strategies were used: (1) three-view orientation only; (2) two-step sequence with two-view orientation followed by three-view; and (3) three-step sequence starting with one-view, then two-view, and finally three-view orientation.

The data collected by Franchak (1971) failed to statistically support the hypothesis that instructional strategies which demonstrate or take into consideration relevant and irrelevant cues would enhance learning. A test of visual-haptic aptitude was given to each subject but did not establish a difference in ability to learn multiview orthographic projection concepts based on method of instruction.

Freschet (1969) examined the concept of self-instructional units for teaching mechanical drawing to subjects of various abilities. Subjects were administered the Weston Mitchell Drawing Aptitude Test

to determine ability and were classified as high, medium, or low level. Subjects from all levels of ability were randomly assigned to the treatment group.

Subjects in the treatment group were given directions for operating the slides and tape recordings which accompanied their workbooks. They were allowed to progress at their own pace through each instructional unit.

Subjects within the treatment group showed significant gains in achievement as measured by the pre and posttest results. No significant differences were found to exist between ability groups' achievement as measured on the same pre and posttest. Attitude was also assessed to determine subjects' responsiveness to the individualized method of instruction. A significant increase in attitude was found after exposure to the system (Freschet, 1969).

When pretest and posttest scores were compared between the treatment and control groups of the Freschet (1969) study, differences in error scores were not significant. The follow-up interviews were emphasized in that they showed favorable attitudes toward the individualized self-instructional method among all subjects involved in the study.

Programmed instruction was compared to video-tape television in teaching selected orthographic projection concepts by Moegenburg (1970). Four groups were established for the treatments of the study which included: (1) programmed instruction with the teacher present; (2) programmed instruction without the teacher present; (3) video-tape television with the teacher present; and (4) video-tape television without the teacher present.

Moegenburg's (1970) findings established that there was no significant difference between the programmed instruction treatments. There was a significant difference between achievement of the programmed instruction group and the video-tape television groups. Also indicated was a preference of programmed instruction over video-tape television when subjects were given the opportunity to express their opinion.

Identification and analysis of elements was also examined for its effectiveness when compared to teaching beginning drafting by conventional methods. (Schanbacher, 1962) The treatment group received instruction which required them to isolate and analyze certain elements of drafting in other views.

The data were analyzed and showed no statistical significance between method of instruction on informational achievement, quality of work, quantity of work, scores on sketching problems, scores on daily instrument drawing, or effects between teachers. The only area of significance occurred when comparing the number of correctly and accurately solved sketching problems. In general, Schanbacher (1962) failed to establish one method as superior to the other.

Hepler (1957) researched the benefits of order of presentation when teaching orthographic projections and pictorial representations. The control group received instruction for orthographic projections first while the treatment group received instruction for pictorial representation. All other factors of class conditions, informational content, and method of instruction were kept as nearly equal as possible.

Presentation of orthographic projections first was found to be superior when examining informational achievement, drawing skill developed, and ability to visualize when making orthographic drawings. The same did not hold true for the final development of skill in making pictorial drawings. Order of presentation did not significantly differ with respect to drawing speed

developed or attitude of the students toward the course. In general, Hepler (1957) established that teaching orthographic projections first was the superior method.

This section of the review of related literature has established the need for conclusive, empirical data regarding the method of instruction which would best facilitate achievement of selected drafting concepts.

Computer-Assisted Instruction

The focal point of research in method of instruction has changed with the increased use of computers in the classroom. Computer-assisted instruction, development and implementation are now being emphasized in research.

Kearsley and Hunter (1983) pointed out that early researchers believed computers would eventually take the place of teachers. Computers of the future would be able to deliver curriculum eliminating the need for teachers.

Early predictions have not materialized, however. Instead of being taught by computers, students are using computers as a tool of education. Kearsley and Hunter (1983) identified several problems that need to be solved before full implementation can be

accomplished. A shortage of quality software available to educators was cited as a major factor.

The second major problem as seen by Kearsley and Hunter (1983) was the absence of computer-literate teachers. Education of teachers cannot keep up with new technologies or students that have worked with home computers since early childhood. Despite lower costs, computer hardware is still difficult for some school systems to afford.

Finally, resistance to new technologies is a factor which will require a group effort on the part of concerned parents and educators to overcome. All of these problems must be faced and overcome in order for computer use in the classroom to reach its potential (Kearsley and Hunter, 1983).

Thomas (1976) collected information in an effort to establish the status of CAI in undergraduate Industrial Arts teacher education programs. Based on a series of questionnaires the major conclusion indicated that institutions of higher education were not preparing Industrial Arts teachers to incorporate CAI in future Industrial Arts programs.

Simpson (1984) conducted a telephone and on-site interview study of Arizona vocational education

programs to examine how computers were being used. In general, Arizona schools use computers to teach programming skills.

Business and drafting programs teach the use of computers as a tool. College level programs teach basic applications where high school vocation programs focus on machine- and program-specific skills. Simpson (1984) stated that few programs or instructors used the computer for classroom management or CAI.

The major obstacles to increased use of CAI were once again found to be inadequate teacher training, availability of software and funds. Based on those findings, recommendations for CAI included evaluation of current resources and materials, development of software for teaching core concepts, and establishment of a state-wide "bank" of software (Simpson, 1984).

In Dixon (1984), learning theories were examined to determine how they may assist or enhance the development and design of CAI software. A general model of curriculum development contains five major components: objectives, pre-assessment, instruction, feedback, and evaluation.

For the purposes of this paper, feedback development will be more closely examined. Criteria

For development of CAI include: providing immediate feedback, the use of positive reinforcers for correct responses, and supplying the correct answer if subjects respond incorrectly (Dixon, 1984).

Skinner's operant conditioning and Hull's drive theory stress the importance of developing positive reinforcers in CAI. Continuity and consistency of the reinforcers should be emphasized based on Pavlov's learning theories so as to avoid extinction (Dixon, 1984).

Dixon (1984) explained the usefulness of saving response time, number of correct responses, etc., for computer analysis using the Mathematical Learning Theory. This information could be used to develop programs based on individualized needs of students. Storing the data involved is the major drawback to this evaluation technique.

Chambers and Sprecher (1983) identify two types of CAI, adjunct which supplements the learning situation and primary which provides instruction that can stand alone. Several advantages were given for using CAI in the classroom. Use of CAI in the classroom requires the individual to become actively involved in the learning process. Reinforcement is immediate and

systematic which should result in more effective learning. Finally, the instructor is freed for more individualized or remedial tasks in the classroom.

Organizations have been developed which attempt to meet the need for information and materials. The United States, United Kingdom, Canada, and Japan are the major centers of activity (Chambers and Sprecher, 1983). Those developed in the United States include: CONDUIT based at Dartmouth University, Minnesota Educational Computing Consortium at Lauderdale, Minnesota, PLATO funded by the National Science Foundation, and TICCIT Time-Shared Interactive Computer-Controlled Information Television project also funded by the National Science Foundation.

The majority of software available is of the adjunct type which has been developed by individuals for a specific purpose. This makes the information difficult to share with other educators. Chambers and Sprecher (1983) stated that methods for integrating CAI materials into the curriculum needs to have a great deal more attention.

Once CAI has been established as the most appropriate method for presenting or reinforcing a concept and the materials have been developed, it must

be incorporated into the curriculum. Steely (1983) reported that three times a week was the ideal time for exposure with once a week being set as minimum.

In a literature search, Forman (1983) examined the effects of CAI on achievement. Four generalizations were developed from what Forman considered to be well designed and controlled studies. Improved learning or no differences were found when comparing CAI to traditional classroom approaches. The effect on achievement was present regardless of the type of CAI, computers, testing or students researched.

In addition, when comparing CAI and traditional methods significantly less time was needed to achieve the same goals using CAI. Finally, subjects involved in the studies had a positive attitude toward CAI which may include benefits such as increased motivation, attention span, and attendance in courses.

Groom (1983) completed an experiment which supported much of the information established above. The study proposed to determine if the use of a combination of traditional and user-oriented interactive computer graphics was an effective method of instruction. The sample for the study included first semester engineering graphics students.

Pre-post test scores established a difference in achievement in favor of the treatment group. The treatment group not only learned additional information but improved their attitude, scores on weekly quizzes and scores on long term tests. The time required to solve graphics problems using CAI was five minutes compared to forty-two minutes for traditional methods. Groom (1983) recommended this method of teaching beginning engineering students graphic principles.

Dahl (1984) compared learning outcomes using drill and practice CAI and simulation CAI strategies. Findings indicated no significant differences on posttest achievement between the two strategies.

The field dependence independence cognitive learning style which involves the process of visual perception as well as problem solving was also examined. A field dependent learner requires more structure in a learning experience for achievement than a field independent learner. Dahl (1984) found no significant interaction between the cognitive learning style and CAI strategies.

There was a significant interaction, however, between sex and CAI strategies. Females scored lower than males on the posttest when the simulation CAI

strategy was applied. In addition, females identified as field dependent received significantly lower scores than their male counterparts in both CAI strategies.

Finally, Poehler (1984) examined the effectiveness of CAI in teaching selected concepts in health. Results showed a significant difference between treatment and control groups on the first chapter test. The benefits of CAI were not present in tests of significance on results for chapters two or three. It was suggested that the significance found in chapter one exams may have been caused by students spending more time on task. The novelty of the CAI format may have temporarily increased the interest and involvement of the subjects.

CHAPTER 3. METHODOLOGY

This study attempted to determine the effects of three methods of instruction on student achievement of selected fundamental drafting concepts. Procedures for the study are described in this chapter including information on the sample, treatments, instrumentation, experimental design and the analysis.

Population

The subjects for this study were taken from students in the School of Technology at Indiana State University, Terre Haute, Indiana. Indiana State University is a land grant university with the majority of students coming from Indiana, although, nearly every state and more than seventy-five foreign countries are represented.

Sample

The sample for this study consisted of one hundred, and five students enrolled in Design Drafting 101 during the fall semester of the 1985-86 school year. Design Drafting 101 is an introductory course in basic drafting concepts and is a requirement of all students enrolled in the departments of Industrial and Mechanical Technology, Manufacturing and Construction Technology and Electronics Technology.

During computer registration in the spring of 1985, five day and four night class sections consisting of twenty to twenty-five students were established. The sample was limited to the day sections to facilitate the scheduling of the researcher and the necessary microcomputer laboratories. The researcher met each section for one hour of lecture and one hour of laboratory twice each week for four weeks. Appendix A and B contain the microcomputer cluster and laboratory assignment schedules respectively.

Instrumentation

In reviewing the literature it appeared that the Multiple Aptitude Tests 8 and 9 (MAT 8 and 9) were suitable for measuring the independent variable of visual-haptic aptitude. The purpose for administering these tests was to determine where each of the subjects in the sample placed on the visual-haptic continuum. Permission was received from McGraw-Hill to reproduce subtests 8 and 9 from the MAT (Appendix C).

Test 8 (Appendix D) is a twenty-five item instrument measuring spatial visualization of two dimensional objects. Subjects were given a whole object and were required to choose from four alternatives the pieces that could be put together to

form that whole. The Kuder-Richardson (K-R) Formula 21, produced a very acceptable reliability coefficient of .87 (Segel and Raskin, 1959b).

Test 9 (Appendix E) is also a twenty-five item instrument which requires the subject to choose the two-dimensional figure which matches a given three-dimensional isometric drawing. The K-R Formula 21 reliability coefficient was an acceptable .78 (Segel and Raskin, 1959b). Normative data were available but not used for either instruments.

Both treatment and control groups were administered General Drafting: A Comprehensive Examination (Appendix F) as a pretest to measure the independent variable of prior knowledge and as a posttest to measure the dependent variable, student achievement. The test was developed and copyrighted by Robert Blum and distributed commercially by the McGraw-Hill Book Company. The instrument was out of print at the time of this study. Several contacts were made with Dr. Blum in obtaining permission to reprint and administer his test instrument (Appendix G).

A pilot administration of the test was carried out in the spring semester of 1985 to eighty-four Design Drafting 101 students at Indiana State University for

the purpose of establishing test reliability. The K-R Formula 21 reliability coefficient of .88 was obtained. Normative data for college level students was available but not used. Coefficients obtained in the pilot were well above the previously normed data.

Experimental Design

The study utilized an extension of the pretest, posttest, control group design to measure the effects of three instructional strategies which included: (1) traditional instructional method; (2) traditional supplemented with CAI utilizing delayed feedback; and (3) traditional supplemented with CAI utilizing immediate feedback. Table 1 identifies the unadjusted mean scores to be derived in the multiple-treatment single factor design.

Table 1. Treatment group independent and dependent variable descriptive statistic notation

Variable	Treatment groups		
	Trad./Cont. Grp.	Trad./Delay CAI	Trad./Immed. CAI
GPA	\bar{X}_{11}	\bar{X}_{12}	\bar{X}_{13}
Pretest	\bar{X}_{21}	\bar{X}_{22}	\bar{X}_{23}
MAT 8 & 9	\bar{X}_{31}	\bar{X}_{32}	\bar{X}_{33}
Posttest	\bar{Y}_{11}	\bar{Y}_{12}	\bar{Y}_{13}

Procedures

The total sample from the five sections of Design Drafting 101 was alphabetized and assigned a number. Subjects were then assigned to either the control group or one of the treatment groups using the random table of numbers.

All subjects were administered General Drafting: A Comprehensive Examination and the Multiple Aptitude Test 8 and 9. Treatments were applied for a four week period followed by a posttest using General Drafting: A Comprehensive Examination. Demographic information collected at the time of the posttest included each subjects' high school cumulative grade point average which were recorded in the special codes block of the subjects posttest answer form and previous drafting and computer experience collected by survey (Appendix H).

Computer-Assisted Instructional Programs

The CAI drill and practice program for both treatment groups utilized a common item bank for generating the instructional units. Each unit consisted of twenty items utilizing orthographic and isometric projection procedures. Three basic geometric shapes were used to develop an item bank containing a combinations.

Subjects were required to enter a name, four digit computer code, and student identification number to initiate the program. The CAI program ensured consistency and randomization through the use of student identification numbers as identifiers and random seeds. Based on the input information the subject was assigned the proper treatment and items. In addition, the CAI program kept a record of the items which had been presented to each subject in order to avoid repetitions. A management sub-program enabled the researcher to monitor individual as well as group progress. Forty duplicate disks were necessary for individualized student use and data storage. The disks were prepared by the researcher in advance to include a subject roster and item data files.

A utilities program (Appendix I) provided item, individual, and group statistics for the CAI treatments. A full source code of the treatment program (Appendix J) and three item data files (Appendix K) are included.

Written instructions (Appendix L) and a demonstration were provided for each treatment group. Subjects were presented with a series of three dimensional isometric drawings and were asked to

identify the correct orthographic view indicated by the line of sight arrow. Five alternatives were provided from which to choose an answer.

The treatment lasted for a period of four weeks. A total of twenty drawing plates are normally assigned during the traditional laboratory time. Subjects in both treatment groups were required to do four less drawing plates due to the time needed to complete the CAI programs. Subjects were aware that performance on the CAI programs would be recorded in lieu of those assignments.

Control group C remained in the classroom during the one hour lecture. Subjects spent the next hour, scheduled as laboratory time, working on traditional paper and pencil assignments. A graduate assistant monitored the laboratory and was available to respond to students' questions.

Subjects in treatment group D remained in the classroom during the lecture. Twenty minutes of the laboratory time were required to complete the CAI program utilizing delayed feedback. Subjects had no knowledge of their performance on individual items until they had completed the program at which time they received a total score. Figure 1 illustrates a sample

item from the CAI program for this treatment.

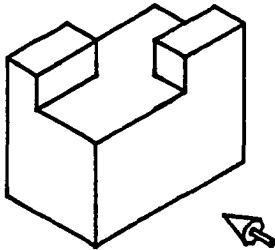


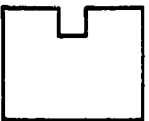

CHOOSE THE ORTHO- GONAL VIEW WHICH IS INDICATED BY THE LINE OF SIGHT ARROW.			
 (A)	 (B)	 (C)	 (D)
(E) NONE OF THE ABOVE			
ENTER YOUR ANSWER AND PRESS RETURN			

Figure 1. Example item from CAI program for treatment utilizing delayed feedback

Subjects in treatment group I also remained in the classroom during the one hour lecture. This group received CAI programs which provided immediate feedback. If subjects responded correctly they received positive reinforcement and the next item was presented. When incorrect answers were given the correct response was displayed on the screen giving the

subject an opportunity to re-examine the item. A sample item is shown in Figure 2.

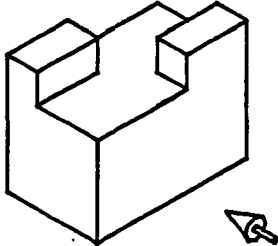




CHOOSE THE ORTHO- GONAL VIEW WHICH IS INDICATED BY THE LINE OF SIGHT ARROW.			
 (A)	 (B)	 (C)	 (D)
(E) NONE OF THE ABOVE			
ENTER YOUR ANSWER AND PRESS RETURN CORRECT, GOOD FOR YOU!			

Figure 2. Example item from CAI program for treatment utilizing immediate feedback

Analysis of Data

The Statistical Package for the Social Sciences (SPSS) was used to complete the statistical analysis. Descriptive statistics including cell means as illustrated in Table 1 were computed. An analysis of covariance was employed in which the General Drafting

posttest scores were compared using the coded treatment groups, grade point average, MAT 8 and 9 scores, and the General Drafting pretest scores as covariates.

Then using a procedure similar to the Wherry-Doolittle (Hinkle, Wiersma and Jurs 1979) which identifies significant predictor variables within a group, inferential statistics were computed comparing significant differences in multiple Rs for three regression models. The resulting F-statistics were used to test the null hypotheses at the .05 level of significance.

The general equation for calculating these test statistics in Chapter 4 is as follows:

$$F_{(K_f - K_r, N - K_f - 1)} = \frac{(R_f^2 - R_r^2)}{(1 - R_f^2)} \cdot \frac{(N - K_f - 1)}{(K_f - K_r)}$$

K_f = Full Model R_f^2 = Full Model
 K_r = Restricted Model R_r^2 = Restricted Model

CHAPTER 4. PRESENTATION OF DATA

The results of the study are presented in this chapter. The test of the null hypotheses presented in chapter three were conducted at the ninety-five percent confidence interval. Descriptive data concerning the subjects are presented first, then the regression models and finally the test statistic calculations for differences between models are presented.

Descriptive Data

The average age of the subjects in the study was 18.8 years. Eighty-three males and twenty-two females participated in the study. The sample included fifty freshman, twenty-six sophomores, twenty-four juniors, and five seniors enrolled in Design Drafting 101. The average high school graduating class size for the sample was 250. Subjects in the sample graduated from high school in the upper thirty percent or better of their class.

Fifty-one percent of the sample had previous experience with microcomputers prior to the start of the experiment. Eighteen of the one hundred and five subjects in the sample owned a microcomputer. Other areas of previous experience included an average of 1.3 semesters of drafting and 4.8 semesters of mathematics.

Table 2 presents the descriptive statistics of the dependent and independent variables for the study. Included are the means and standard deviations for all treatment groups.

Table 2. Descriptive statistics for tests of dependent and independent variables by treatment group

Variables	Treatment groups					
	Trad./Cont. Grp.		Trad./Delay CAI		Trad./Immed. CAI	
	Mean	SD	Mean	SD	Mean	SD
GPA	2.26	.74	2.14	.85	2.34	.84
Pretest	44.14	18.92	38.86	17.98	46.94	18.72
MAT 8 & 9	34.94	5.76	33.89	6.55	35.00	5.59
Posttest	65.06	14.42	63.29	13.39	68.29	12.59

Testing of the Hypotheses

In the following paragraphs, the results are presented as they relate to each hypothesis in the study. A regression analysis is presented for the model equations relative to the individual hypotheses. An F-statistic is calculated to determine significant difference between multiple Rs of the regression equations.

The notation for the dependent and independent variables of the study follow:

\hat{Y} = Dependent Variable Posttest Achievement

X_1 = High School Grade Point Average (0.0-4.0)

X_2 = General Drafting Pretest Raw Score (140pts.)

X_3 = Visual Aptitude MAT 8 & 9 (50pts.)

X_4 = Delayed Feedback Treatment Group D

X_5 = Immediate Feedback Treatment Group I

X_{14} = Interaction GPA & Treatment Delayed

X_{15} = Interaction GPA & Treatment Immediate

X_{24} = Interaction Pretest & Treatment Delayed

X_{25} = Interaction Pretest & Treatment Immediate

X_{34} = Interaction Visual Aptitude & Trt. Delayed

X_{35} = Interaction Visual Aptitude & Trt. Immediate

The first hypothesis states:

There will be no significant difference of achievement scores on the posttest between the control group, and the treatment groups receiving the CAI feedback structures.

$$H_{01}: B_j = 0 \text{ for } j = 4, 5$$

A comparison was made between the multiple Rs of a model containing the treatment variables (Full) and a model not containing them (Restricted).

Model #1 (Restricted)

$$\hat{Y} = B_1X_1 + B_2X_2 + B_3X_3 + B_0$$

Table 3 presents the multiple regression results

for the restricted model.

Table 3. Results of regression analysis and significance tests for the dependent variable posttest

Dependent variable	R ² for full model	Independent variables	Sums of squares ^a	F-value
Posttest (Y)	.496	GPA (X ₁)	3.082	.082
		Pretest (X ₂)	71.297	.000*
		MAT 8&9 (X ₃)	4.979	.028*

^aType III sums of squares. (SPSS^x User's Guide)

*P < .05.

Model #2 (Full)

$$\hat{Y} = B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_0$$

Table 4 presents the results of the multiple regression of this full model.

The following are the calculations for the F-statistic needed to test the first hypothesis (H₀₁).

$$\begin{array}{lll} \text{Given: } K_f = 5 & N = 105 & R_f^2 = 0.49913 \\ & & R_r^2 = 0.49609 \\ & K_r = 3 & \end{array}$$

Find:

$$F_{(2,99)} = \frac{(0.49913 - 0.49609)}{(1 - 0.49913)} \cdot \frac{99}{2} = 0.3015$$

Critical Value = 19.48 (P < .05)

Table 4. Results of regression analysis and significance tests for the dependent variable posttest

Dependent variable	R^2 for full model	Independent variables	Sums of squares ^a	F-value
Posttest (Y)	.499	GPA (X_1)	2.968	.088
		Pretest (X_2)	68.298	.000*
		MAT 8&9 (X_3)	4.969	.028*
		TRTD (X_4)	.268	.606
		TRTI (X_5)	.572	.451

^aType III sums of squares.

* $P < .05$.

Based upon the data reported in Table 3 and Table 4 it was concluded that there is no difference between the posttest scores of the control and treatment groups. Therefore, there is a failure to reject H_{01} . The same logic is used to test for differences between groups when the second order interactions, beyond the treatments and covariates, are included. These interactions are stated in the second, third and fourth hypothesis (H_{02} , H_{03} , H_{04}) below, followed by

the statistical test for the combined interactions.

2. There will be no significant interaction between the treatments and grade point average in relation to a subject's posttest score.

$$H_{02}: B_j = 0 \text{ for } j = 6, 7$$

3. There will be no significant interaction between the treatments and pretest scores in relation to a subject's score on the posttest.

$$H_{03}: B_j = 0 \text{ for } j = 8, 9$$

4. There will be no significant interaction between the treatments and visual-haptic aptitude as measured by the Multiple Aptitude Test 8 and 9 in relation to a subject's posttest score.

$$H_{04}: B_j = 0 \text{ for } j = 10, 11$$

The previous full model becomes the new restricted model and the full model includes the second order interactions.

Model #2 (Restricted)

$$\hat{Y} = B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_0$$

Model #3 (Full)

$$\begin{aligned} \hat{Y} = & B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_1X_4 + B_7X_1X_5 + B_8X_2X_4 \\ & + B_9X_2X_5 + B_{10}X_3X_4 + B_{11}X_3X_5 + B_0 \end{aligned}$$

In Table 5, the results of the multiple regression of the full model are presented.

Table 5. Results of regression analysis and significance tests for the dependent variable posttest

Dependent variable	R ² for full model	Independent variables	Sums of squares ^a	F-value
Posttest (Y)	.525	GPA (X ₁)	.307	.581
		Pretest (X ₂)	30.075	.000*
		MAT 8&9 (X ₃)	1.853	.177
		TRTD (X ₄)	.813	.370
		TRTI (X ₅)	.138	.670
		GPA by TRTD (X ₁₄)	.137	.712
		GPA by TRTI (X ₁₅)	.126	.723
		PRET by TRTD (X ₂₄)	.099	.753
		PRET by TRTI (X ₂₅)	1.480	.227
		MAT by TRTD (X ₃₄)	.953	.332
		MAT by TRTI (X ₃₅)	.815	.369

^aType III sums of squares.

*p < .05.

The following are the calculations for the F-statistic to test H_{O2} , H_{O3} , H_{O4} .

$$\begin{array}{llll} \text{Given: } K_f = 11 & N = 105 & R_f^2 = 0.52525 \\ & & R_r^2 = 0.49913 \\ & K_r = 5 & \end{array}$$

Find:

$$F_{(6,93)} = \frac{(0.52525 - 0.49913)}{(1 - 0.52525)} \cdot \frac{93}{6} = 0.7708$$

$$\text{Critical Value} = 3.72 \quad (P < .05)$$

This indicates that the second order interactions beyond the treatments and covariates do not contribute significantly to posttest achievement scores at the .05 level. Thus, the results failed to provide the necessary evidence to reject hypotheses H_{O2} , H_{O3} and H_{O4} .

CHAPTER 5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the effectiveness of an adjunct CAI program which employed two feedback structures as compared to the traditional method of presenting introductory drafting concepts. The drill and practice CAI program required the subjects to identify the correct orthographic view of a given isometric object.

The sample for this study consisted of one hundred, and five college level students enrolled in Design Drafting 101 in the School of Technology at Indiana State University, Terre Haute, Indiana during the fall semester of the 1985-86 school year. Design Drafting 101 is an introductory course in basic drafting concepts and is a requirement of all students enrolled in departments of Industrial and Mechanical Technology, Manufacturing and Construction Technology and Electronics Technology.

All subjects were administered General Drafting: A Comprehensive Examination as a pretest and the Multiple Aptitude Test 8 and 9 as a measure of visual-haptic aptitude. Treatments were applied for four weeks which is the normal period of time used during

the semester for presenting the concept of orthographic projection. The treatments were followed by a posttest using General Drafting: A Comprehensive Examination. Demographic information was also collected at the time of the posttest.

The research project was designed to blend with the regular department schedule of classes and philosophy of teaching. The tests and methods of testing were also designed to cause a minimum amount of deviation from the normal classroom routine. The CAI program was designed to supplement the method of instruction already in use by the department.

The researcher met each section for one hour of lecture and one hour of laboratory twice a week for four weeks. In addition to the two treatment groups, a control group was established to maintain experimental control. The CAI drill and practice program was completed by the subjects in Treatment groups I and D during the scheduled laboratory time. The groups received two different feedback structures for determining the effect of delayed and immediate reinforcement on achievement.

The group receiving delayed feedback was allowed forty seconds to respond to each of twenty items.

Subjects were given no indication as to the accuracy of their responses until the end of the treatment when they were informed of the number of correct responses. Subjects in the immediate feedback group were also given forty seconds to answer each item. A correct answer was recognized with a positive reinforcer. Incorrect responses were indicated as such and the correct response was identified giving the subject an opportunity to examine it.

The researcher identified four alternative hypotheses then stated them in Chapter 1 as null hypotheses which were used to test for differences in achievement between groups. The major hypothesis stated that the treatment groups would show higher achievement scores than the control group with the immediate feedback group having the highest achievement. The other hypotheses were used to determine if differences existed between posttest achievement scores when the covariates of prior knowledge, multiple aptitude and grade point average were taken into consideration.

Conclusions

Table 2 in Chapter 4 tends to support the major hypothesis when the covariates are taken into account.

Although there was no significant difference between the three methods of instruction, there was a considerable increase in achievement in all three treatment groups. These findings would affirm that all three methods were equally effective in producing the desired results.

Based on the data provided in Tables 3 and 4 of Chapter 4 it was concluded that there was no significant difference of scores on the achievement posttest between the control group, the treatment group receiving the delayed feedback CAI and the treatment group receiving the immediate feedback CAI. Therefore, based on the F-value, 0.3015, calculated in Chapter 4 the null hypothesis was not rejected.

The F-test presented in Chapter 4 for hypotheses H_{02} , H_{03} , and H_{04} showed no significant differences between groups when second order interactions were included. It was, therefore, determined unnecessary to partition each of the interactions and test them for individual significance.

Based on the F-value, 0.7708, as calculated in Chapter 4, there was no significant interaction between the treatments and grade point average in relation to a subject's posttest score. It should be noted in the

regression analysis in Chapter 4, Table 5 that the F-values for GPA by TRTD and TRTI were .712 and .723 respectfully. This also indicates the lack of a significant interaction at the .05 level.

As indicated by the F-value, 0.7708 calculated in Chapter 4, there was no significant interaction between the treatments and pretest scores in relation to a subject's score on the posttest. Using the regression analysis in Chapter 4, Table 5 the F-value .753 was obtained for PRET by TRTD and .227 for PRET by TRTI once again indicating the lack of interaction at the .05 level.

Based on the F-value, 0.7708, as calculated in Chapter 4, from Tables 4 and 5, there was no significant interaction between the treatments and visual-haptic aptitude as measured by the Multiple Aptitude Test 8 and 9 in relation to a subject's posttest score. The regression analysis in Chapter 4, Table 5, produced the F-value .332 for MAT by TRTD and .369 for MAT by TRTI demonstrating the lack of interaction at the .05 level of significance.

Researchers Observations

The following additional observations were made by the researcher:

It was noted, throughout the study, that subjects receiving the immediate feedback were more motivated and approached the subject matter more enthusiastically. This supports the findings of Forman (1983) which found increased motivation, attention span, and attendance in courses as a benefit of using CAI. When asked about a preference, the researcher found that 73% of the subjects in the study chose to include the CAI as a part of the laboratory exercises.

Even though students in Treatment group I actually spent less time in the laboratory the posttest scores were better, although not to a significant degree, than subjects in the control group as shown in Chapter 4, Table 2.

While significant differences in scores did not exist, the students in Treatment group I did perform slightly better on the posttest. In addition, students in Treatment group I required less time to complete laboratory exercises (20 minutes as opposed to 50 minutes) and appeared more motivated. This once again parallels the findings of Forman (1983) and Groom (1983) that less time was needed to achieve the same goals using CAI.

Cost effectiveness and classroom management are

areas that need to be examined when considering CAI. The value of CAI when compared to traditional methods is seen when examining time spent in the laboratory, textbooks and materials required and retrieval of instructional data. Gains in management such as item response times, group statistics and immediate performance information were found to be most beneficial to the researcher.

Dixon's (1984) examination of learning theories stated that CAI feedback should be immediate, positive and indicate mistakes in order to be most effective. This was based on theories posed by Skinner and Hull. The findings of this study did not indicate feedback of this type to have a significant effect on achievement.

The mean grade point average of the subjects may have been a contributing factor in the study. The researcher found that it falls below the norm for freshmen university students. Further analysis would need to be conducted to determine if students in the upper and lower ends of the GPA continuum affected the findings.

Limitations

The following limitations were discovered at the conclusion of the research experiment:

1. The time devoted to the CAI was restricted to a total eight session or twice a week for four weeks. Other studies have shown maximum benefits occur when exposure is set at three times a week.

2. A normal distribution of subjects on the GPA continuum were not found in the study.

Recommendations

Simpson (1984) stated that few programs or instructors used the computer for classroom management or CAI due to inadequate teacher training, and availability of software and funds. Dixon, (1984) found storage of data to be a major drawback or obstacle to developing CAI programs based on student needs.

The CAI program developed by this researcher is a step toward developing a model for collecting, organizing and analyzing data on a micro-computer for instructional management. Although, several technical problems still exist with storing and sorting the response information, once they are solved the problems posed by Simpson (1984) and Dixon (1984) can be addressed.

The researcher makes the following suggestions for further study:

This CAI program should be modified to include a routine for estimating each subjects' understanding of the content and adapting the items to a new level of difficulty at each execution of the treatment.

Once the above mentioned modification is made a replication of this study should be carried out including this information in the prediction equation.

This study should be duplicated increasing the treatment period and the content covered by the CAI program. However, the previously mentioned technical problems need to be addressed before this is possible.

Further study is needed in the area of visual perception. The CAI items could be adapted to measure visual perception. The program could then be used to collect response information and analyze it in such a way so as to measure differences between subjects that no other method up to this point has accomplished.

Subsequent investigation should be undertaken to determine the adaptability of computer-assisted instruction in other areas of industrial education and technology.

Replication of this study with an increase in the number of participants would lend strength to the statistical analysis.

Finally, the study should be replicated using junior high and/or high school students to determine if age is a contributing factor in achievement using this CAI strategy.

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APPENDIX A. MICRO-COMPUTER LABORATORY
RESERVATION SCHEDULE

To: Mr. Doug Smith
Director Computer Center

From: Ron Woolsey
Industrial & Mechanical Technology

Re: Scheduling of microcomputer clusters

I would like to be placed on the schedule for the micro-computer clusters in the fall semester of 1985 as we discussed in our phone conversation.

My request is for Tuesdays and Thursdays from September 24th through October 24th. The exact dates are as follows:

	<u>Tues.</u>	<u>Thurs.</u>
September	24	26
October	1	3
	8	10
	15	17
	22	24

I have four classes which meet from 8:00-10:00; 10:00-12:00; 1:00-3:00; and 3:00-5:00 with a maximum of twenty students using the cluster during each section. To facilitate instructional method and research control I would like to be scheduled for the second hour of each class if possible. The program being used in my research requires IBM-PC compatible computers. After the orientation sessions on September 24th and 26th some adjustments could be made to share the laboratory facilities with others.

I would appreciate receiving written confirmation of my scheduled times as soon as possible. Any change or variation from the requested time will add another variable to my research study which would then require a great deal of modification in the design of the experiment.

In the event that you need to contact me this summer call Shirley Jones at ext. 5571. She will be able to relay information to me as I plan on being out of town until July.

APPENDIX B. IMT 101 RESEARCH PROJECT SCHEDULE

Date	Lecture Topics	Lab. Assign.	
		Ctrl	*Trt.
Sept.	10 Scales and Instruments Administer General Drafting Pre-test	7,8	7,8
	12 Geometric Construction	9,10	9,10
	17 Tangencies	11,12	11,12
	19 Quiz #1 (Scales, Geometric Construction) Administer Multiple Aptitude Test 8 & 9		
	24 Orthographic Projection Treatment "I" (BLK1 - BLK20)	18,19	18 (I)
	26 Orthographic Projection Treatment "D" (BLK1 - BLK20)	20,21	20 (D)
Oct.	1 Orthographic Projection Treatment "I" (BLK21 - BLK40)	22,23,24	22,23 (I)
	3 Orthographic Projection Treatment "D" (BLK21 - BLK40)	26,27	26 (D)
	8 Orthographic Projection Treatment "I" (BLK41 - BLK60)	28,29	28 (I)
	10 Orthographic Projection Treatment "D" (BLK41 - BLK60)	30,31	30 (D)
	15 Auxiliary Views Treatment "I" (BLK61 - BLK80)	32,33	32 (I)
	17 Auxiliary Views Treatment "D" (BLK61 - BLK80)	34	34 (D)
	22 Administer General Drafting Post-test		

The reduced assignment load will apply to the treatment group that will be leaving the lab early on the days indicated.

APPENDIX C. CORRESPONDENCE - MCGRAW-HILL

CTB/McGraw-Hill

Del Monte Research Park
2500 Garden Road
Monterey, California 93940
Telephone 408/649-8400



September 13, 1985

Prof. Ronald C. Woolsey
Indiana State University
Room 215, Classroom Building
Terra Haute, Indiana 47809

Dear Professor Woolsey:

CTB/McGraw-Hill is pleased to grant you permission to reproduce Subtests 8. and 9. from the MULTIPLE APTITUDE TESTS for use in your doctoral research program. This permission also allows you to include Items 1-4. from the subtests in the appendix of your dissertation.

Please give the following acknowledgment:

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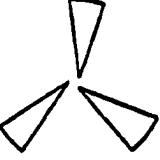
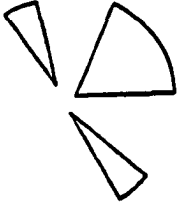
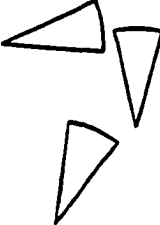











If I may be of further assistance, please let me know.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Phyllis O'Donovan".

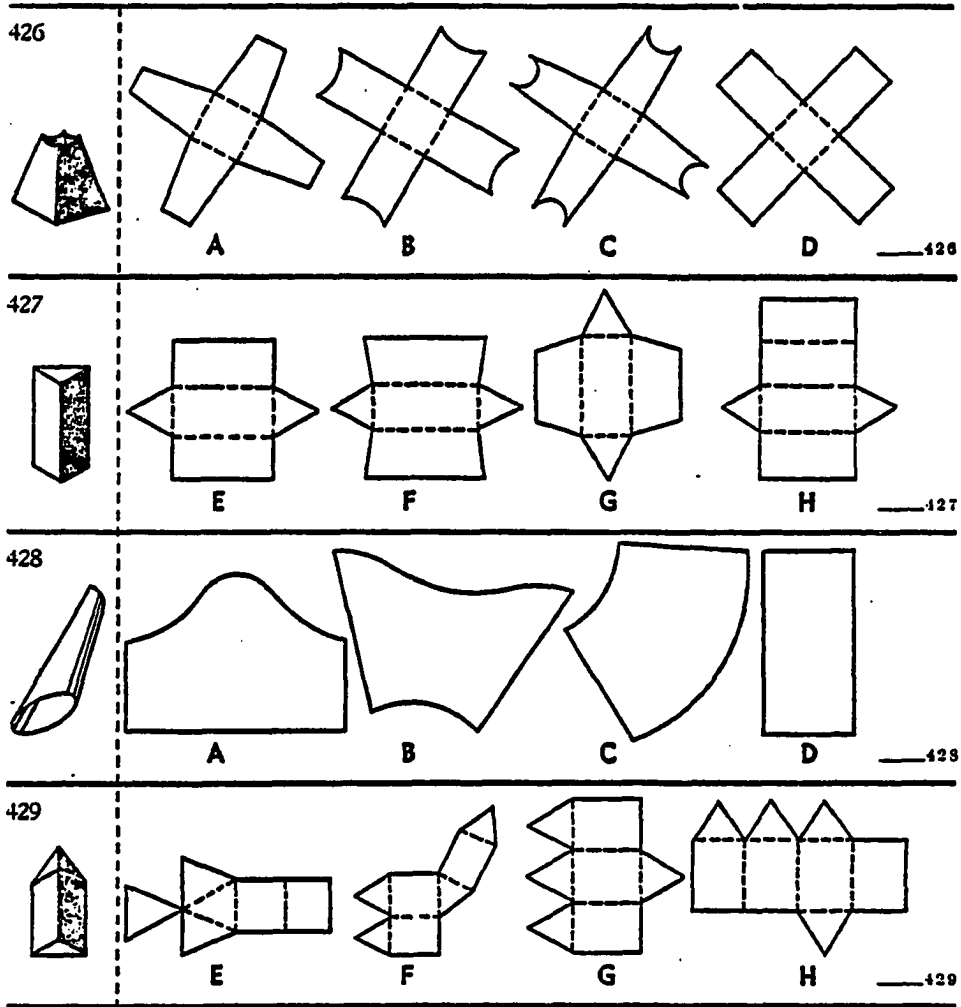
Phyllis O'Donovan, Editor
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APPENDIX D. MULTIPLE APTITUDE TEST BATTERY 8
ITEMS 401-404 (1-4 OF 25)

401		 A	 B	 C	 D	— 401
402		 E	 F	 G	 H	— 402
403		 A	 B	 C	 D	— 403
404		 E	 F	 G	 H	— 404

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APPENDIX E. MULTIPLE APTITUDE TEST BATTERY 9
ITEMS 426-429 (1-4 OF 25)



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GENERAL DRAFTING

A COMPREHENSIVE EXAMINATION

Copyright 1964

Robert E. Blum

Orthographic Projection

67. Line **D** in figure 35 is:
 a. a phantom line.
 b. a dotted line.
 c. a hidden line.
 d. a center line.

68. Line **C** in figure 35 is:
 a. a cutting plane line.
 b. a hidden line.
 c. a middle line.
 d. a center line.

69. Line **A** in figure 35 is:
 a. an outline.
 b. a solid line.
 c. an object line.
 d. an exterior line.

70. Line **B** in figure 35 is:
 a. a center line. c. a cutting plane line.
 b. a section line. d. an object line.

71. The top view of the object shown in figure 36 should look like:

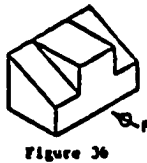
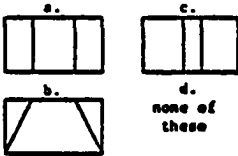


Figure 36

72. The front view of the object shown in figure 37 should look like:

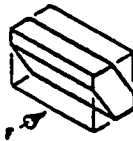
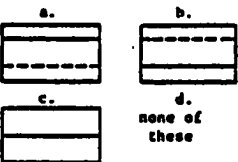


Figure 37

73. The top view of the object shown in figure 38 should look like:

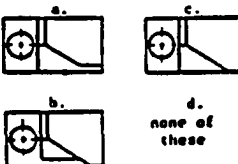


Figure 38

© R. E. BLUM 1974

74. Plane **DCN** shown in figure 39 will project true shape in:
 a. the front view. c. the right side view.
 b. the top view. d. an auxiliary view.

75. Plane **CCMN** shown in figure 39 will project true shape in:
 a. the front view.
 b. the right side view.
 c. the top view.
 d. an auxiliary view.

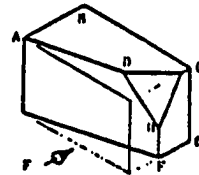


Figure 39

76. Line **AD** shown in figure 39 will project true length in:
 a. the top view.
 b. the front view.
 c. the right side view.
 d. an auxiliary view.

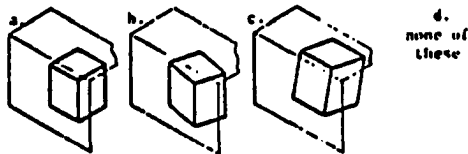
77. To be complete, the object shown in figure 40 should have:

- a. an object line from e to f.
 b. an object line from a to b.
 c. an object line from c to d.
 d. none of these.



Figure 40

78. To completely describe an object with orthographic multi-view projection, the best relationship of the object to the principal planes of projection is:



d. none of these

79. Plane **A** in figure 41 is:
 a. a profile plane.
 b. a frontal plane.
 c. an inclined plane.
 d. a horizontal plane.

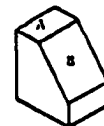


Figure 41

80. Plane **B** in figure 41 is:
 a. a frontal plane. c. an inclined plane.
 b. a profile plane. d. a slanted plane.

Pictorial Drawing

52. In an isometric drawing, angle A shown in Figure 25 is:

a. 100° . c. 120° .
b. 115° . d. none of these.

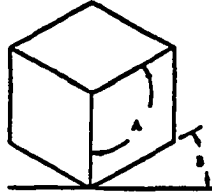
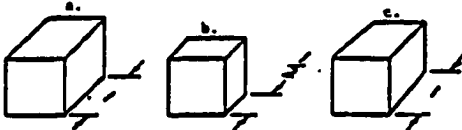


Figure 25

53. In an isometric drawing, angle B shown in Figure 25 is:

a. 30° . c. 20° .
b. 25° . d. none of these.

54. A cabinet drawing of a cube should look like:



d. none of these

55. An isometric drawing of the object shown in Figure 26 should look like:

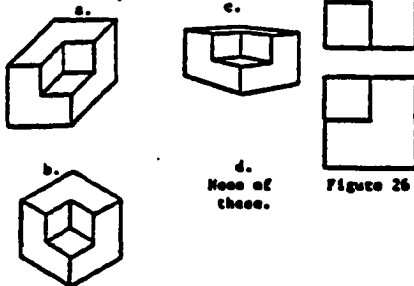


Figure 26

56. To construct the irregular curve shown in Figure 27 in an isometric drawing you must:

- place several points along the curve, locate these points in the isometric drawing, and connect them with an irregular curve.
- find center for several arcs which compose the curve, locate these centers in the isometric drawing, and draw the line with a compass.
- find the centers for several arcs which compose the curve, locate these in the isometric drawing and construct the line, using several approximate four-center ellipses.
- none of these are correct.



Figure 27

57. When measuring in an isometric drawing, the proper scale to use is:

a. an isometric scale. c. an ordinary scale.
b. a metric scale. d. any of these.

58. To draw line 1,2 shown in Figure 28 in an isometric drawing you must:

- locate point 2 and draw from 2 to 1 with a 60° angle.
- locate point 1 and draw from 1 to 2 with a 60° angle.
- locate points 1 and 2 and connect them with a straightedge.
- none of these are correct.

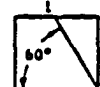


Figure 28

59. Line 1,2 in Figure 28 is called:

a. an isometric line. c. an angle line.
b. an irregular line. d. a nonisometric line.

60. The type of projection shown in Figure 29 is:

a. isometric. c. perspective.
b. orthographic. d. oblique.

61. If dimension A in Figure 29 is drawn half-size, the drawing is called:

a. cabinet. c. cavalier.
b. half-size. d. isometric.

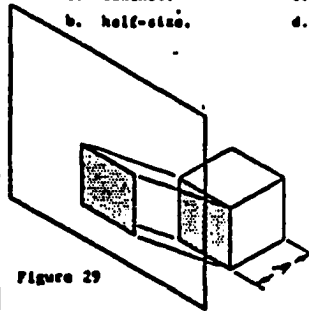


Figure 29



Figure 30

62. To make an effective oblique projection of the object shown in Figure 30, surface A should be:

- parallel to the plane of projection.
- perpendicular to the plane of projection.
- at a 45° angle to the plane of projection.
- at a 30° angle to the plane of projection.

63. A nonisometric line shown in Figure 31 is:

a. DE.
b. BC.
c. AE.
d. CD.

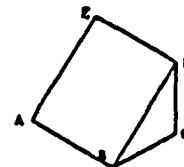


Figure 31

APPENDIX G. CORRESPONDENCE - ROBERT E. BLUM



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TELEX: 701716 CABLE: NWREL SOURCE: STL958

November 8, 1984

Ronald C. Woolsey
Assistant Professor of Technology
Indiana State University
School of Technology (IMT)
Terre Haute, Indiana 47809

Dear Ron:

Enclosed is a copy of my dissertation. It is my only copy. I hope it helps. Please return it as soon as possible.

Sincerely,

A handwritten signature in cursive script, appearing to read "Robert E. Blum".

Robert E. Blum, Director
Goal Based Education Program

REB:dr

Enclosure



Indiana State University

School of Technology
Department of Industrial & Mechanical Technology

January 17, 1984

Robert E. Blum, Director
300 S. W. Sixth Avenue
Portland, Oregon 97204

Dear Dr. Blum:

Enclosed you will find the copy of your dissertation. I would like to thank you again for sending the copy and allowing me to use your placement test. I would appreciate a written confirmation of permission to use the test for my records. If an answer key is available I would like a copy of it as well.

Sincerely,

Ronald C. Woolsey
Indiana State University
Assistant Professor of Technology

Enclosure



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February 8, 1985

Ronald C. Woolsey
School of Technology
Indiana State University
Terre Haute, Indiana 47809

Dear Ronald:

I received the copy of my dissertation and your letter dated January 17, 1985. You may use my placement test in your research. I do not have an answer key available, so you will need to use the information from the back of the dissertation.

Please let me know if I can help further.

Sincerely,

Robert E. Blum, Director
Goal Based Education Program

REB:dr



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February 21, 1985

Ronald C. Woolsey
School of Technology
Indiana State University
Terre Haute, Indiana 47809

Dear Ronald:

In going through some old files this past weekend, I found answer keys to
General Drafting: A Comprehensive Examination. I am sending them along
for your use.

Sincerely,

Robert E. Blum, Director
Goal Based Education Program

REB:drx

Enclosure

APPENDIX H. INSTRUCTIONS FOR ADMINISTERING
DEMOGRAPHIC SURVEY

I have given you a questionnaire to obtain background information concerning each of you. Place your social security number in the space marked ID # and your class code in the space marked Code #. Read each question carefully. Answer the 12 items, to the best of your knowledge, by placing an 'X' in the appropriate space or providing the information. All information obtained in this questionnaire will be kept in strict confidence. When you have completed all the questions turn your sheet face down, raise your hand and I will come by and pick up the form.

Class code refers to a system of identifying course sections particular to Indiana State University.

ID # _____-_____-_____

Code # _____

Demographic Information Survey
(All responses will be kept in strict confidence)

Please answer the following questions with an "X" or a response in the space provided.

1. How many semesters of mechanical drawing, architectural drawing, etc. did you have in grades 9 through 12? _____
2. How many semesters of mathematics , algebra, geometry, etc. did you have in grades 9 through 12? _____
3. Approximately, how many hours experience do you have playing video games? _____
4. What was your class rank when you graduated from high school? _____
5. What was your high school graduating class size? _____
6. What is your sex? () female () male
7. What time does this course meet
 () morning () afternoon () evening
8. What is your present student classification?
 () freshman () sophomore () junior () senior
9. Have you had any previous course instruction on using computers?
 () yes () no
10. Do you own a micro-computer? () yes () no
11. Are you aware of any uncorrectable visual problem you might have such as color blindness?
 () yes . () no
12. Have you ever worked in a position that employed drafting machines or traditional drafting equipment?
 () yes () no

APPENDIX I. UTILITIES SOURCE PROGRAM

```

10 REM *** *** *** *** *** *** *** *** *** *** ***
20 REM ***      UTILITIES PROGRAM REV 1.2      ***
30 REM ***      SORT AND PRINT ITEM DATA      ***
40 REM ***      Copyright c  Ronald Casper Woolsey, ***
50 REM ***      1986.  All rights reserved      ***
60 REM *** *** *** *** *** *** *** *** *** *** ***
65 REM
70 REM
75 DIM ID4$(80,21),G$(80,21),L$(80,21),F4$(80,21)
80 DIM CD4$(80,21),T4$(80,21),WSD$(80,21),RSPT(80,21)
90 DIM SC$(80),SC(80),Z(80),ZSC(80),T(80)
100 DIM W(80),NM$(80),RGT$(80):CLS:FLGS9=0
110 PRINT "THIS PROGRAM IS FOR GENERATING TEST ANALYSIS
DATA."
120 PRINT
130 PRINT "DO YOU WISH TO PRINT OUT PREVIOUSLY SORTED
DATA? (Y/N)";
140 REPT$=" "
150 REPT$=INKEY$
160 IF LEN(REPT$)=0 THEN 150
170 IF ASC(REPT$)=13 THEN 150
180 IF REPT$ = "N" OR REPT$ = "n" THEN 240
190 IF REPT$ = "NO" OR REPT$ = "no" THEN 240
200 IF REPT$ = " " THEN 150
210 IF REPT$ = "Y" OR REPT$ = "y" THEN GOSUB 2470
220 IF FLGS9=1 THEN 1660
230 GOTO 150
240 PRINT
250 PRINT "TYPE IN THE TEST NAME AND PRESS RETURN.";
260 INPUT TST$
270 PRINT
280 PRINT "TYPE IN THE WEEK OR TEST NUMBER AND PRESS
RETURN.";
290 INPUT TN
300 PRINT
310 PRINT "TYPE IN THE NUMBER OF ITEMS ON THE TEST.";
320 INPUT ITM
330 CLS
340 PRINT "INSERT TREATMENT DISK IN DRIVE B AND PRESS
RETURN."
350 B$=" "
360 B$=INKEY$
370 IF LEN(B$)=0 THEN 360
380 IF ASC(B$)<>13 THEN 360
390 C=0:R=0

```

```

400 OPEN "I",#2,"B:ITM.DAT"
410 FOR R=1 TO 850
420 LOCATE 11,37:PRINT "DATA#"
430 LOCATE 12,38:PRINT R
440 FOR C=1 TO 20
450 INPUT#2,CD4%(R,C),ID4%(R,C),G%(R,C),L$(R,C),
F4$(R,C),T4,$(R,C),WSD%(R,C),RSPT(R,C)
460 IF EOF(2) THEN GOTO 490
470 NEXT C
480 GOTO 590
490 CLOSE#2
500 PRINT:PRINT "DO YOU HAVE MORE DISKS? (Y/N)";
505 INPUT DSK$
510 IF DSK$="N" THEN GOTO 610
520 CLS
525 PRINT
530 PRINT "INSERT DISK IN DRIVE B AND PRESS RETURN."
540 A$=" "
550 A$=INKEY$
560 IF LEN(A$)=0 THEN 550
570 IF ASC(A$)<>13 THEN 550
580 OPEN "I",#2,"B:ITM.DAT"
590 NEXT R
600 CLS
610 COLOR 4,15,0
620 WIDTH 40
630 LOCATE 4,13:PRINT "< PLEASE >"
640 LOCATE 6,10:PRINT "< DON'T TOUCH ME >"
650 LOCATE 8,11:PRINT "< I'M SORTING >"
660 LOCATE 10,10:PRINT"< FOR MR. WOOLSEY >"
670 FG1=0
680 FOR I=1 TO R
690 LOCATE 12,18
695 PRINT I
700 FOR J=1 TO C-1
710 IF G%(I,J)<=G%(I,J+1) THEN 970
720 X0%=CD4%(I,J)
730 X1%=ID4%(I,J)
740 X2%=G%(I,J)
750 X3%=L$(I,J)
760 X4%=F4$(I,J)
770 X5%=T4$(I,J)
780 X6%=WSD%(I,J)
790 X7=RSPT(I,J)
800 CD4%(I,J)=CD4%(I,J+1)
810 ID4%(I,J)=ID4%(I,J+1)
820 G%(I,J)=G%(I,J+1)

```

```

830 L$(I,J)=L$(I,J+1)
840 F4$(I,J)=F4$(I,J+1)
850 T4$(I,J)=T4$(I,J+1)
860 WSD$(I,J)=WSD$(I,J+1)
870 RSPT(I,J)=RSPT(I,J+1)
880 CD4$(I,J+1)=X0%
890 ID4$(I,J+1)=X1%
900 G$(I,J+1)=X2%
910 L$(I,J+1)=X3$
920 F4$(I,J+1)=X4$
930 T4$(I,J+1)=X5$
940 WSD$(I,J+1)=X6%
950 RSPT(I,J+1)=X7
960 FG1=1
970 NEXT J
980 NEXT I
990 IF FG1=1 THEN GOTO 670
1000 FG2=0
1010 FOR J=1 TO C
1020 LOCATE 12,18:PRINT J
1030 FOR I=1 TO R-1
1040 IF ID4$(I,J)<=ID4$(I+1,J) THEN 1300
1050 Y0%=CD4$(I,J)
1060 Y1%=ID4$(I,J)
1070 Y2%=G$(I,J)
1080 Y3$=L$(I,J)
1090 Y4$=F4$(I,J)
1100 Y5$=T4$(I,J)
1110 Y6%=WSD$(I,J)
1120 Y7=RSPT(I,J)
1130 CD4$(I,J)=CD4$(I+1,J)
1140 ID4$(I,J)=ID4$(I+1,J)
1150 G$(I,J)=G$(I+1,J)
1160 L$(I,J)=L$(I+1,J)
1170 F4$(I,J)=F4$(I+1,J)
1180 T4$(I,J)=T4$(I+1,J)
1190 WSD$(I,J)=WSD$(I+1,J)
1200 RSPT(I,J)=RSPT(I+1,J)
1210 ID4$(I+1,J)=Y1%
1220 CD4$(I+1,J)=Y0%
1230 G$(I+1,J)=Y2%
1240 L$(I+1,J)=Y3$
1250 F4$(I+1,J)=Y4$
1260 T4$(I+1,J)=Y5$
1270 WSD$(I+1,J)=Y6%
1280 RSPT(I+1,J)=Y7
1290 FG2=1

```

```

1300 NEXT I
1310 NEXT J
1320 IF FG2=1 THEN GOTO 1000
1330 FG3=0
1340 FOR J=1 TO C
1350 LOCATE 12,18:PRINT J
1360 FOR I=1 TO R-1
1370 IF T4$(I,J)<=T4$(I+1,J) THEN 1630
1380 Z0%=CD4%(I,J)
1390 Z1%=ID4%(I,J)
1400 Z2%=G%(I,J)
1410 Z3%=L$(I,J)
1420 Z4%=F4$(I,J)
1430 Z5%=T4$(I,J)
1440 Z6%=WSD%(I,J)
1450 Z7=RSPT(I,J)
1460 CD4%(I,J)=CD4%(I+1,J)
1470 ID4%(I,J)=ID4%(I+1,J)
1480 G%(I,J)=G%(I+1,J)
1490 L$(I,J)=L$(I+1,J)
1500 F4$(I,J)=F4$(I+1,J)
1510 T4$(I,J)=T4$(I+1,J)
1520 WSD%(I,J)=WSD%(I+1,J)
1530 RSPT(I,J)=RSPT(I+1,J)
1540 CD4%(I+1,J)=Z0%
1550 ID4%(I+1,J)=Z1%
1560 G%(I+1,J)=Z2%
1570 L$(I+1,J)=Z3%
1580 F4$(I+1,J)=Z4%
1590 T4$(I+1,J)=Z5%
1600 WSD%(I+1,J)=Z6%
1610 RSPT(I+1,J)=Z7
1620 FG3=1
1630 NEXT I
1640 NEXT J
1650 IF FG3=1 THEN GOTO 1330
1660 CLS
1670 WIDTH 80:SCREEN 0:COLOR 2,0,0
1680 LPRINT TAB(5)"ANALYSIS DATA FOR TEST "TST$
1690 LPRINT TAB(5)"TOTAL # OF ITEMS "ITM
1700 LPRINT TAB(5)"WEEK# "TN
1710 LPRINT:LPRINT
1720 LPRINT TAB(35)"ITEM DATA TABLE"
1730 LPRINT
"=====
=====
1740 LPRINT " ID# 1 2 3 4 5 6 7 8 9 10 11 12

```

```

13 14 15 16 17 18 19 20  RWS  SC%"
1750 LPRINT
"=====
=====
1760 FOR ROW=1 TO R
1770 IF FLG6=1 THEN GOTO 1810
1780 IF T4$(ROW,1)="I" THEN 1790 ELSE 1810
1790 LPRINT "-----
-----"
1800 FLG6=1
1810 RW=ROW+4
1820 LPRINT TAB(1)ID4$(ROW,1);
1830 FOR COL=1 TO C
1840 IF L$(ROW,COL)=F4$(ROW,COL) THEN 1870
1850 W=W+1
1860 CY=(COL*3)+6:LPRINT TAB(CY)"*";
1870 NEXT COL
1880 RGT$(ROW)=C-W:SC$(ROW)=(RGT$(ROW)/C)*100
1890 CX=((COL*3)+6)
1900 IF RGT$(ROW)<10 THEN 1920
1910 GOTO 1930
1920 CX=CX+1
1930 LPRINT TAB(CX)RGT$(ROW) " "SC$(ROW)
1940 W=0:CY=0:CX=0
1950 NEXT ROW
1960 CLOSE
1970 LPRINT
"=====
=====
1980 LPRINT:LPRINT
1990 OPEN "O",#2,"SRT.DAT"
2000 FOR P=1 TO R
2010 FOR Q=1 TO C
2020 RSPT(P,Q)=RSPT(P,Q)/80
2030 WRITE#2,CD4$(P,Q),ID4$(P,Q),G$(P,Q),L$(P,Q),
F4$(P,Q),T4$(P,Q),WSD$(P,Q),RSPT(P,Q)
2040 NEXT Q
2050 NEXT P
2060 CLOSE
2070 CLS
2080 PRINT "STAT-1"
2090 N=R
2100 FOR I=1 TO N
2110 SC(I)=RGT$(I)
2120 T=T+SC(I)
2130 NEXT I
2140 AV=T/N

```

```

2150 P=N
2160 FOR J=1 TO N
2170 D=SC(J)-AV
2180 SR=SR+D
2190 NEXT J
2200 Q=SR/N
2210 SE=(SQR(Q))/(SQR(N))
2220 LPRINT TAB(10)"SAMPLE STATISTICS"
2230 LPRINT "=====
2240 LPRINT "      1.  SUM OF SQUARES ="SR
2250 LPRINT "      2.  VARIANCE      ="Q
2260 LPRINT "      3.  STANDARD DEV.  ="SQR(Q)
2270 LPRINT "      4.  MEAN (AVERAGE) ="AV
2280 LPRINT "      5.  STD MEAN ERROR ="SE
2290 LPRINT "      6.  TOTAL ( N )    ="R
2300 LPRINT "=====
2310 N=P
2320 FOR I=1 TO N
2330 Z(I)=SC(I)-AV
2340 ZSC(I)=Z(I)/SQR(Q)
2350 T(I)=10*ZSC(I)+50
2360 NEXT I
2370 LPRINT:LPRINT
2380 LPRINT TAB(20)"Z-SCORES AND T-SCORES"
2390 LPRINT
"=====
2400 LPRINT TAB(5)"ID#";TAB(16)"RAW SC.";TAB(28)"Z-
SCORE";TAB(42)"T-SCORE"
2410 FOR J=1 TO N
2420 LPRINT TAB(4)ID4%(J,1);TAB(18)SC(J);
TAB(28)ZSC(J);TAB(42)T(J)
2430 W(J)=J
2440 NEXT J
2450 LPRINT
"=====
2460 END
2470 CLS
2480 GOSUB 3320
2490 CLS
2500 FLGS9=1
2510 PRINT "TYPE IN THE TEST NAME AND PRESS RETURN.";
2520 INPUT TST$
2530 PRINT
2540 PRINT "TYPE IN THE WEEK OR TEST NUMBER AND PRESS
RETURN.";
2550 INPUT TN
2560 PRINT

```

```
2570 PRINT "TYPE IN THE TOTAL NUMBER OF ITEMS ON THE
TEST.";
2580 INPUT ITM
2590 CLS
2600 PRINT "INSERT DATA DISK IN DRIVE B AND PRESS
RETURN."
2610 B$=" "
2620 B$=INKEY$
2630 IF LEN(B$)=0 THEN 2620
2640 IF ASC(B$)<>13 THEN 2620
2650 C=0:R=0
2660 IF CHS = 1 THEN 2680
2670 GOTO 2700
2680 OPEN "I",#2,"B:WK1.DAT"
2690 GOTO 2880
2700 IF CHS = 2 THEN 2720
2710 GOTO 2740
2720 OPEN "I",#2,"B:WK2.DAT"
2730 GOTO 2880
2740 IF CHS = 3 THEN 2760
2750 GOTO 2780
2760 OPEN "I",#2,"B:WK3.DAT"
2770 GOTO 2880
2780 IF CHS = 4 THEN 2800
2790 GOTO 2820
2800 OPEN "I",#2,"B:WK4.DAT"
2810 GOTO 2880
2820 IF CHS = 5 THEN 2840
2830 GOTO 2860
2840 OPEN "I",#2,"B:SRT.DAT"
2850 GOTO 2880
2860 IF CHS = 6 THEN 3500
2870 GOTO 2480
2880 FOR R=1 TO 850
2890 LOCATE 11,37:PRINT "DATA#"
2900 LOCATE 12,38:PRINT R
2910 FOR C=1 TO 20
2920 INPUT#2,CD4$(R,C),ID4$(R,C),G$(R,C),L$(R,C),
F4$(R,C),T4$(R,C),WSD$(R,C),RSPT(R,C)
2930 IF EOF(2) THEN GOTO 2960
2940 NEXT C
2950 GOTO 3280
2960 CLOSE#2
2965 PRINT
2970 PRINT "DO YOU HAVE MORE DISKS? (Y/N)";:INPUT DSK$
2980 IF DSK$="N" OR DSK$="n" THEN GOTO 3290
2990 IF LEN(DSK$)=0 THEN 2970
```



```

3000 GOSUB 3320
3005 PRINT
3010 PRINT "INSERT DISK IN DRIVE B AND PRESS RETURN."
3020 A$=" "
3030 A$=INKEY$
3040 IF LEN(A$)=0 THEN 3030
3050 IF ASC(A$)<>13 THEN 3030
3060 IF CHS = 1 THEN 3080
3070 GOTO 3100
3080 OPEN "I",#2,"B:WK1.DAT"
3090 GOTO 3280
3100 IF CHS = 2 THEN 3120
3110 GOTO 3140
3120 OPEN "I",#2,"B:WK2.DAT"
3130 GOTO 3280
3140 IF CHS = 3 THEN 3160
3150 GOTO 3180
3160 OPEN "I",#2,"B:WK3.DAT"
3170 GOTO 3280
3180 IF CHS = 4 THEN 3200
3190 GOTO 3220
3200 OPEN "I",#2,"B:WK4.DAT"
3210 GOTO 3280
3220 IF CHS = 5 THEN 3240
3230 GOTO 3020
3240 OPEN "I",#2,"B:SRT.DAT"
3250 GOTO 3280
3260 IF CHS = 6 THEN 3500
3270 GOTO 3000
3280 NEXT R
3290 CLS
3300 RETURN
3310 END
3320 CLS
3330 PRINT"
*****"
3340 PRINT"
*      * * * M A I N   M E N U * * *      *"
3350 PRINT"
*                                          *"
3360 PRINT"
*      ENTER YOUR CHOICE FROM THE MENU      *"
3370 PRINT"
*                                          *"
3380 PRINT"
*      1.   WEEK #1           4.   WEEK #4      *"
3390 PRINT"

```

```
*
3400 PRINT"
*      2.  WEEK #2          5.  SORTED(SRT)
3410 PRINT"
*
3420 PRINT"
*      3.  WEEK #3          6.  QUIT
3430 PRINT"
*
3440 PRINT"
*      ENTER THE NUMBER ==>
3450 PRINT"
*
3460 PRINT"
*****
3470 PRINT:PRINT:PRINT
3480 LOCATE 12,42:INPUT CHS
3490 RETURN
3500 END
```

APPENDIX J. TREATMENT SOURCE PROGRAM

```

10 REM *** *** *** *** *** *** *** *** *** *** ***
20 REM ***      STUDENT TREATMENT PROGRAM REV 2.1      ***
30 REM ***      PROGRAM TO DEVELOP STUDENT VISUAL      ***
40 REM ***      PERCEPTION OF MULTIVIEW DRAWINGS      ***
50 REM ***      Copyright c  Ronald Casper Woolsey, ***
60 REM ***      1986. All rights reserved              ***
70 REM *** *** *** *** *** *** *** *** *** *** ***
75 REM
80 REM
85 C=0:COLOR 2
90 GOSUB 4730
100 REM *****
110 N=20:REM *** NUMBER OF QUESTION AVAILABLE ***
120 REM *****
130 LOCATE 10,30:PRINT ". . . W A I T . . ."
140 LOCATE 12,27:PRINT "P R E S S   C A P S   L O C K"
150 FOR A=1 TO 3000:NEXT A
160 SEED=4
170 FLAG=0
180 FOR H=1 TO 7
190 RANDOMIZE SEED
200 SEED%=INT(RND*10)+.5
210 NEXT H
220 REM *****
230 REM *** IDENTIFY CODE NUMBER ***
240 REM *****
250 GOSUB 4730
260 INPUT "ENTER YOUR NAME, THEN PRESS RETURN. ";N$
270 IF N$="QUIT" THEN 5190
280 IF LEN(N$)=0 THEN GOTO 260
290 PRINT
300 INPUT "ENTER YOUR CLASS CODE NUMBER THEN PRESS
RETURN. ";CD$
310 IF CD$="ENERGY" THEN GOTO 340
320 IF LEN(CD$)<>4 THEN GOTO 290
330 IF LEN(CD$)=0 THEN GOTO 290
340 PRINT
350 PRINT "TYPE IN THE LAST FOUR DIGITS OF YOUR STUDENT
NUMBER "
360 PRINT
370 INPUT "AND PRESS RETURN. ";ID%
380 IF ID%<0 OR ID%>9999 THEN 440
390 IF ID% = 0 THEN GOTO 440
400 IF ID%>=1 OR ID%<=9999 THEN GOTO 460
410 IF ERR = 50 THEN GOTO 440

```

```

420 IF ERR = 13 THEN 440
430 GOTO 460
440 PRINT:PRINT "RE-ENTER ?";:INPUT ID%
450 GOTO 380
460 PRINT
470 PRINT "ARE ALL THE ENTRYS CORRECT (Y/N).==>";
480 E$=INKEY$:IF LEN(E$)=0 THEN 480
490 PRINT E$
500 IF E$< >"Y" THEN GOTO 520
510 GOTO 530
520 PRINT:GOTO 260
530 GOSUB 4730
540 LOCATE 12,30:PRINT ". . . W A I T . . ."
550 IF CD$="ENERGY" AND ID%=5993 THEN GOSUB 3260
560 IF FLAG=1 THEN GOTO 5030
570 REM *****
580 REM *** COMPARE WITH CLASS LIST ***
590 REM *****
600 CD%=VAL(CD$)
610 OPEN "R",#1,"ROSTER.DAT",22
620 FIELD #1,3 AS R$,1 AS F$,6 AS U$,4 AS V$,2 AS W$,1
   AS T$
630 FOR I=1 TO 150:RECORD%=I
640 GET #1,RECORD%:V%=CVI(V$):Z%=VAL(U$)
650 IF Z%=CD% AND V%=ID% THEN 700
660 NEXT I:CLOSE #1
670 CLS:LOCATE 10,5:PRINT "I CAN FIND YOUR ID NUMBER,
   PLEASE TRY AGAIN."
680 FOR AA=1 TO 1600:NEXT AA
690 GOTO 160
700 GOSUB 4730
710 REM *****
720 REM *** INSTRUCTIONS TEXT ***
730 REM *****
740 PRINT:PRINT
750 PRINT N$;", THIS IS AN EXERCISE TO INCREASE
   YOUR UNDERSTANDING "
760 PRINT
770 PRINT "OF BASIC MULTIVIEW DRAWING CONCEPTS.
   THERE ARE ";N;" ITEMS"
780 PRINT
790 PRINT "WHICH SHOULD TAKE APPROXIMATELY 20
   MINUTES TO COMPLETE."
800 PRINT
810 PRINT "MAKE SURE YOU ALLOW AMPLE TIME TO
   COMPLETE THE EXERCISE."
820 PRINT

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```

830 PRINT "YOU MUST WORK THROUGH THE ENTIRE EXERCISE
TO RECEIVE CREDIT."
840 PRINT
850 PRINT "IF YOU HAVE ANY QUESTIONS CONSULT THE LAB
ASSISTANT."
860 PRINT
870 GOSUB 4630
880 GOSUB 4730
890 PRINT:PRINT
900 PRINT "EACH DRAWING WILL PRESENT FIVE CHOICES,
SELECT THE BEST ANSWER"
910 PRINT
920 PRINT "BY ENTERING THE LETTER OF YOUR CHOICE.
YOU MAY CHANGE YOUR"
930 PRINT
940 PRINT "ANSWER ANY NUMBER OF TIMES BUT YOU WILL ONLY
HAVE APPROXIMATELY"
950 PRINT
960 PRINT "FORTY SECONDS TO COMPLETE EACH ITEM. GOOD
LUCK!"
970 PRINT
980 GOSUB 4630
990 GOSUB 4730
1000 LOCATE 12,30:PRINT ". . . W A I T . . ."
1010 REM *****
1020 REM *** CHECK ASSIGNMENT "I" OR "D"***
1030 REM *****
1040 IF T$="I" THEN GOTO 1090
1050 IF T$="D" THEN GOTO 1090
1060 CLOSE #1
1070 GOSUB 2910
1080 GOTO 90
1090 CLOSE #1
1100 REM *****
1110 REM *** NON-REPEATING ITEM GENERATOR ***
1120 REM *****
1130 DIM G%(121),L$(121)
1140 DIM QTS(500),X(500),Y(500),P(500)
1150 DIM ID4%(121),F4$(121),T4$(121)
1160 DI%=ID%+SEED%
1170 RANDOMIZE DI%
1180 DIM D(N+1),R(N+1)
1190 FOR J=1 TO N
1200 D(J) = INT(N * RND(1) + 1)
1210 FOR K=1 TO J
1220 IF D(J)=R(K) THEN GOTO 1200
1230 NEXT K

```

```
1240 R(K)=D(J)
1250 REM *****
1260 REM *** READ DATA TO PLOT DRAWING ***
1270 REM *****
1280 FOR D=1 TO N
1290 READ Q%,F$
1300 IF Q%< >R(K) THEN GOTO 2700
1310 IF Q%=1 THEN GOTO 1520
1320 IF Q%=2 THEN GOTO 1540
1330 IF Q%=3 THEN GOTO 1560
1340 IF Q%=4 THEN GOTO 1580
1350 IF Q%=5 THEN GOTO 1600
1360 IF Q%=6 THEN GOTO 1620
1370 IF Q%=7 THEN GOTO 1640
1380 IF Q%=8 THEN GOTO 1660
1390 IF Q%=9 THEN GOTO 1680
1400 IF Q%=10 THEN GOTO 1700
1410 IF Q%=11 THEN GOTO 1720
1420 IF Q%=12 THEN GOTO 1740
1430 IF Q%=13 THEN GOTO 1760
1440 IF Q%=14 THEN GOTO 1780
1450 IF Q%=15 THEN GOTO 1800
1460 IF Q%=16 THEN GOTO 1820
1470 IF Q%=17 THEN GOTO 1840
1480 IF Q%=18 THEN GOTO 1860
1490 IF Q%=19 THEN GOTO 1880
1500 IF Q%=20 THEN GOTO 1900
1510 GOTO 2700
1520 OPEN "I",#2,"BLK1.DAT"
1530 GOTO 1910
1540 OPEN "I",#2,"BLK2.DAT"
1550 GOTO 1910
1560 OPEN "I",#2,"BLK3.DAT"
1570 GOTO 1910
1580 OPEN "I",#2,"BLK4.DAT"
1590 GOTO 1910
1600 OPEN "I",#2,"BLK5.DAT"
1610 GOTO 1910
1620 OPEN "I",#2,"BLK6.DAT"
1630 GOTO 1910
1640 OPEN "I",#2,"BLK7.DAT"
1650 GOTO 1910
1660 OPEN "I",#2,"BLK8.DAT"
1670 GOTO 1910
1680 OPEN "I",#2,"BLK9.DAT"
1690 GOTO 1910
1700 OPEN "I",#2,"BLK10.DAT"
```

```

1710 GOTO 1910
1720 OPEN "I",#2,"BLK11.DAT"
1730 GOTO 1910
1740 OPEN "I",#2,"BLK12.DAT"
1750 GOTO 1910
1760 OPEN "I",#2,"BLK13.DAT"
1770 GOTO 1910
1780 OPEN "I",#2,"BLK14.DAT"
1790 GOTO 1910
1800 OPEN "I",#2,"BLK15.DAT"
1810 GOTO 1910
1820 OPEN "I",#2,"BLK16.DAT"
1830 GOTO 1910
1840 OPEN "I",#2,"BLK17.DAT"
1850 GOTO 1910
1860 OPEN "I",#2,"BLK18.DAT"
1870 GOTO 1910
1880 OPEN "I",#2,"BLK19.DAT"
1890 GOTO 1910
1900 OPEN "I",#2,"BLK20.DAT"
1910 INPUT#2,Q$,X$,Y$,C$
1920 C=C+1
1930 QTS(C)=VAL(Q$):X(C)=VAL(X$):Y(C)=VAL(Y$)
1935 P(C)=VAL(C$)
1940 IF EOF(2) THEN GOTO 1960
1950 GOTO 1910
1960 CLOSE #2
1970 REM *****
1980 REM *** ENTER GRAPHICS MODE ***
1990 REM *****
2000 CLS
2010 SCREEN 1,0:COLOR 1
2020 LINE (0,0)-(0,174):LINE -(319,174)
2025 LINE -(319,0):LINE -(0,0)
2030 LINE (1,1)-(1,173):LINE -(318,173)
2035 LINE -(318,1):LINE -(1,1)
2040 FOR A=1 TO C-1
2050 Y1=(199-Y(A)):Y2=(199-Y(A+1))
2060 X1=X(A):X2=X(A+1)
2070 IF P(A+1) = 2 THEN GOTO 2100
2080 LINE (X1,Y1)-(X2,Y2)
2090 GOTO 2110
2100 LINE (X1,Y1)-(X2,Y2),0
2110 NEXT A
2120 LOCATE 2,2:PRINT "CHOOSE THE ORTHO-"
2130 LOCATE 4,2:PRINT "GONAL VIEW WHICH"
2140 LOCATE 6,2:PRINT "IS INDICATED BY THE"

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2150 LOCATE 8,2:PRINT "LINE OF SIGHT ARROW."
2160 LOCATE 14,4:PRINT "(A)"
2170 LOCATE 14,14:PRINT "(B)"
2180 LOCATE 14,24:PRINT "(C)"
2190 LOCATE 14,34:PRINT "(D)"
2200 LOCATE 21,2:PRINT "(E)  NONE OF THE ABOVE"
2210 LOCATE 23,1
2215 PRINT "ENTER YOUR ANSWER AND PRESS RETURN. "
2220 FLG2=0:FLG3=0
2230 FOR F=1 TO 3200
2240 IF FLG2=1 THEN 2320
2250 IF FLG3=1 THEN 2370
2260 ANS$=INKEY$
2270 IF LEN(ANS$)=0 THEN 2440
2280 IF ANS$<"A" OR ANS$>"E" THEN 2430
2290 IF ANS$>="A" OR ANS$<="E" THEN 2310
2300 GOTO 2440
2310 FLG2=1:PRINT ANS$
2320 RET$=INKEY$
2330 IF LEN(RET$)=0 THEN 2440
2340 IF ASC(RET$)=13 THEN 2360
2350 GOTO 2440
2360 FLG3=1:FLG2=0:LOCATE 24,1:PRINT ". . . OK (Y/N)?"
2370 OK$=INKEY$
2380 IF LEN(OK$)=0 THEN 2440
2390 IF ASC(OK$)=78 THEN 2420
2400 IF ASC(OK$)=89 THEN 2490
2410 GOTO 2440
2420 FLG3=0
2430 LOCATE 24,1:PRINT "          RE-ENTER ?";
2440 NEXT F
2450 LOCATE 24,1:PRINT "TIME LIMIT EXCEEDED";
2460 FOR A=1 TO 900:NEXT A
2470 S$="TL"
2480 GOTO 2500
2490 S$=ANS$
2500 CT=CT+1:ID4$(CT)=ID$(CT):G$(CT)=R(K):L$(CT)=S$
2505 F4$(CT)=F$:T4$(CT)=T$
2510 IF T$="D" THEN 2660
2520 REM *****
2530 REM *** TREATMENT IMMEDIATE FEEDBACK ***
2540 REM *****
2550 IF S$=F$ THEN GOTO 2600
2560 LOCATE 24,1
2565 PRINT "INCORRECT, THE CORRECT ANSWER IS ";F$;"."
2570 FOR E=1 TO 4400
2580 NEXT E

```



```

2590 GOTO 2670
2600 LOCATE 24,1:PRINT "YOU ARE CORRECT."
2610 FOR E=1 TO 1100:NEXT E
2620 W=W + 1:GOTO 2670
2630 REM *****
2640 REM *** TREATMENT DELAY FEEDBACK ***
2650 REM *****
2660 IF S$=F$ THEN W=W+1
2670 GOSUB 4730
2680 IF D=N+1 THEN GOTO 2700
2690 LOCATE 12,10:PRINT ". . . W A I T . . ."
2700 NEXT D
2710 C=0
2720 RESTORE
2730 NEXT J
2740 SCREEN 0:WIDTH 80:COLOR 2
2750 GOSUB 3190
2760 GOSUB 2800
2770 GOTO 5030
2780 END
2790 REM *****
2800 REM *** SUBROUTINE WRITE ID# AND SCORE TO FILE ***
2810 REM *****
2820 OPEN "I",#2,"SCORE.DAT"
2830 OPEN "O",#3,"COPY.DAT"
2840 INPUT#2,N2$,CD2$,ID2$,T2$,T2
2850 WRITE#3,N2$,CD2$,ID2$,T2$,T2
2860 IF EOF(2) THEN GOTO 2880
2870 GOTO 2840
2880 CLOSE #2:KILL "SCORE.DAT"
2890 N2$=N$:CD2$=CD$:ID2$=ID$:T2$=T$:T2=T
2900 WRITE#3,N2$,CD2$,ID2$,T2$,T2
2910 CLOSE #3
2920 OPEN "I",#3,"COPY.DAT"
2930 OPEN "O",#2,"SCORE.DAT"
2940 INPUT#3,N2$,CD2$,ID2$,T2$,T2
2950 WRITE#2,N2$,CD2$,ID2$,T2$,T2
2960 IF EOF(3) THEN GOTO 2980
2970 GOTO 2940
2980 CLOSE #3:KILL "COPY.DAT"
2990 CLOSE #2
3000 RETURN
3010 REM *****
3020 REM *** ITEM ANSWER KEY ***
3030 REM *****
3040 DATA 1.,"B"
3050 DATA 2.,"D"

```

```

3060 DATA 3., "C"
3070 DATA 4., "B"
3080 DATA 5., "C"
3090 DATA 6., "B"
3100 DATA 7., "D"
3110 DATA 8., "B"
3120 DATA 9., "A"
3130 DATA 10., "C"
3140 DATA 11., "C"
3150 DATA 12., "C"
3160 DATA 13., "E"
3170 DATA 14., "A"
3171 DATA 15., "D"
3172 DATA 16., "A"
3173 DATA 17., "A"
3174 DATA 18., "D"
3175 DATA 19., "A"
3176 DATA 20., "B"
3180 REM *****
3190 REM *** SUBROUTINE FIGURE SCORE ***
3200 REM *****
3210 CLS
3220 PRINT "YOU ANSWERED "W" QUESTIONS CORRECTLY OUT OF
A TOTAL OF "N"."
3230 T = INT(((W)/N)*100)+.5)
3240 PRINT:PRINT "YOUR SCORE IS "T"%."
3250 RETURN
3260 REM *****
3270 REM *** SUBROUTINE ROSTER ***
3280 REM *****
3290 OPEN "R", #1, "ROSTER.DAT", 22
3300 FIELD #1, 3 AS R$, 1 AS F$, 6 AS U$, 4 AS V$,
2 AS W$, 1 AS T$
3310 WKSD$=1
3320 IF FLAG=1 THEN RETURN
3330 PRINT:PRINT TAB(8) "FUNCTIONS":PRINT
3340 PRINT 1, "INITIALIZE ROSTER"
3350 PRINT 2, "CREATE OR ADD TO ROSTER"
3360 PRINT 3, "DISPLAY AN INDIVIDUAL"
3370 PRINT 4, "CHANGE ENTRY TO ROSTER"
3380 PRINT 5, "DELETE A RECORD"
3390 PRINT 6, "DISPLAY COMPLETE ROSTER"
3400 PRINT 7, "DISPLAY INDIVIDUALS SCORES"
3410 PRINT 8, "QUIT"
3420 PRINT:PRINT:PRINT TAB(8) "FUNCTION==>";
3430 B$=INKEY$:IF LEN(B$)=0 THEN 3430
3440 IF ASC(B$)=49 THEN GOSUB 3540

```

```

3450 IF ASC(B$)=50 THEN GOSUB 3650
3460 IF ASC(B$)=51 THEN GOSUB 3890
3470 IF ASC(B$)=52 THEN GOSUB 3990
3480 IF ASC(B$)=53 THEN GOSUB 4170
3490 IF ASC(B$)=54 THEN GOSUB 4250
3500 IF ASC(B$)=55 THEN GOSUB 4500
3510 IF ASC(B$)=56 THEN GOSUB 4370
3520 GOTO 3320
3530 REM *****
3540 REM *** INITIALIZE ROSTER ***
3550 REM *****
3560 INPUT "ARE YOU SURE (Y/N) ";C$
3565 IF C$<>"Y" THEN RETURN
3570 FOR I=1 TO 150
3580 RECORD%=I
3590 LSET R$=MKI$(RECORD%)
3600 LSET F$="I"
3610 PUT#1,RECORD%
3620 NEXT I
3630 RETURN
3640 REM *****
3650 REM *** CREATE NEW ROSTER ***
3660 REM *****
3670 PRINT:INPUT "ARE YOU SURE (Y/N) ==>";P$
3680 IF P$<>"Y" THEN RETURN
3690 PRINT "ENTER NUMBER OF RECORDS TO ENTER==>";
3700 INPUT LOOP
3710 PRINT "BEGINNING WITH RECORD#==>";
3720 INPUT START
3730 LPS=LOOP+START
3740 FOR I=START TO (LPS-1)
3750 RECORD%=I
3760 INPUT "CLASS CODE#==>";CD$
3770 INPUT "STUDENT ID#==>";ID%
3780 INPUT "TREATMENT (I/D) ==>";G$
3790 LSET R$=MKI$(RECORD%)
3800 LSET F$="F"
3810 LSET U$=CD$
3820 LSET V$=MKI$(ID%)
3830 LSET W$=MKI$(WKSD%)
3840 LSET T$=G$
3850 PUT #1,RECORD%
3860 NEXT I
3870 RETURN
3880 REM *****
3890 REM *** DISPLAY A ROSTER ENTRY ***
3900 REM *****

```

```

3910 GOSUB 4410
3920 GET #1,RECORD%
3930 IF F$="I" THEN PRINT "EMPTY RECORD":RETURN
3940 FOR I=1 TO 25:PRINT:NEXT I:PRINT:PRINT
3950 PRINT "RECORD#","CODE","ID#","TRT"
3960 PRINT CVI(R$),U$,CVI(V$),T$
3970 RETURN
3980 REM *****
3990 REM *** CHANGE ENTRY TO ROSTER ***
4000 REM *****
4010 GOSUB 4410
4020 PRINT "ARE YOU SURE (Y/N) ";
4030 INPUT P$
4040 IF P$<>"Y" THEN RETURN
4050 INPUT "CLASS CODE NUMBER===>";CD$
4060 INPUT "STUDENT ID NUMBER===>";ID%
4070 INPUT "TREATMENT (I/D)===>";G$
4080 LSET F$="F"
4090 LSET R$=MKI$(RECORD%)
4100 LSET U$=CD$
4110 LSET V$=MKI$(ID%)
4120 LSET W$=MKI$(WKSD%)
4130 LSET T$=G$
4140 PUT #1,RECORD%
4150 PRINT:RETURN
4160 REM *****
4170 REM *** DELETE A RECORD FROM ROSTER ***
4180 REM *****
4190 GOSUB 4410:PRINT "ARE YOU SURE (Y/N) ";
4200 INPUT H$:IF H$<>"Y" THEN RETURN
4210 LSET F$="I"
4220 PUT #1,RECORD%
4230 PRINT:RETURN
4240 REM *****
4250 REM *** DISPLAY COMPLETE ROSTER ***
4260 REM *****
4270 C=1:FOR I=1 TO 25:PRINT:NEXT I
4280 PRINT "RECORD#","CODE","ID#","WEEK","TRT":PRINT
4290 FOR I=1 TO 150:RECORD%=I
4300 GET #1,RECORD%
4310 IF F$<>"F" THEN 4330
4320 PRINT CVI(R$),U$,CVI(V$),CVI(W$),T$
4330 NEXT I
4340 PRINT:PRINT "END OF FILE":PRINT
4350 GOSUB 4630:RETURN
4360 REM *****
4370 FLAG=1: REM *** SET FLAG FOR REPEAT ***

```

```

4380 REM *****
4390 RETURN
4400 REM *****
4410 REM *** ENTER RECORD NUMBER ***
4420 REM *****
4430 PRINT:INPUT "RECORD NUMBER==>";RECORD%
4440 IF (RECORD%<1) OR (RECORD%>150) THEN GOTO 4460
4450 GOTO 4480
4460 PRINT "BAD ID NUMBER":GOTO 4470
4470 PRINT:PRINT:GOTO 4430
4480 GET#1,RECORD%:RETURN
4490 REM *****
4500 REM *** SUBROUTINE CHECK INDIVIDUAL SCORES ***
4510 REM *****
4520 GOSUB 4270
4530 GOSUB 4430:S%=CVI(V$):NUM$=U$
4540 OPEN "I",#2,"SCORE.DAT"
4550 INPUT#2,N2$,CD2$,ID2$,T2$,T2
4560 IF S%=ID2% THEN PRINT N2$,CD2$,ID2$,T2$,T2
4570 IF EOF(2) THEN GOTO 4590
4580 GOTO 4550
4590 PRINT:PRINT "END OF FILE"
4600 CLOSE #2
4610 RETURN
4620 REM *****
4630 REM *** SUBROUTINE RETURN TO CONTINUE ***
4640 REM *****
4650 PRINT:PRINT:PRINT
4660 PRINT TAB(10)"PRESS RETURN TO CONTINUE"
4670 A$=" "
4680 A$=INKEY$
4690 IF LEN(A$)=0 THEN 4680
4700 IF ASC(A$)<>13 THEN 4680
4710 RETURN
4720 REM *****
4730 REM *** CLEAR SCEEN ***
4740 REM *****
4750 CLS
4760 RETURN
4770 REM *****
4780 REM *** WRITE ITEMS TO FILE ***
4790 REM *****
4800 OPEN "I",#2,"ITM.DAT"
4810 OPEN "O",#1,"CPY.DAT"
4820 INPUT#2,ID5%,Q5%,S5$,F5$,T5$
4830 WRITE#1,ID5%,Q5%,S5$,F5$,T5$
4840 IF EOF(2) THEN GOTO 4860

```

```
4850 GOTO 4820
4860 CLOSE #2:KILL "ITM.DAT"
4870 FOR A=1 TO CT
4880 WRITE#1,ID4$(A),G$(A),L$(A),F4$(A),T4$(A)
4890 NEXT A
4900 CLOSE #1
4910 OPEN "I",#1,"CPY.DAT"
4920 OPEN "O",#2,"ITM.DAT"
4930 INPUT#1,ID6$,Q6$,S6$,F6$,T6$
4940 WRITE#2,ID6$,Q6$,S6$,F6$,T6$
4950 IF EOF(1) THEN GOTO 4970
4960 GOTO 4930
4970 CLOSE #1:KILL "CPY.DAT"
4980 CLOSE #2
4990 RETURN
5000 *****
5010 *** WRAP UP ***
5020 *****
5030 IF FLAG=1 THEN GOTO 5190
5040 GOSUB 4730
5050 LOCATE 12,30:PRINT ". . . W A I T . . ."
5060 GOSUB 4780
5070 GOSUB 4730
5080 PRINT "THE EXERCISE IS COMPLETE AND YOUR SCORE HAS
BEEN"
5090 PRINT
5100PRINT "RECORDED.  REMOVE THE DISK FROM THE
COMPUTER AND"
5110 PRINT
5120PRINT "PLACE IT IN ITS PAPER JACKET CAREFULLY AND
RETURN"
5130 PRINT
5140PRINT "IT TO THE LAB ASSISTANT.  DON'T FORGET TO
TURN OFF"
5150 PRINT
5160 PRINT "THE MONITOR AND COMPUTER BEFORE YOU LEAVE."
5170 PRINT
5180 CLOSE
5190 END
```

APPENDIX K. TREATMENT INPUT DATA FILE - BLOCKS

BLOCK #1

1.,	261.55,	109.08,	2
2.,	261.55,	133.57,	1
3.,	240.33,	121.33,	1
4.,	240.33,	145.82,	1
5.,	208.51,	164.19,	1
6.,	240.33,	145.82,	1
7.,	277.46,	167.25,	1
8.,	272.15,	170.32,	1
9.,	282.76,	176.44,	1
10.,	288.06,	173.38,	1
11.,	293.37,	176.44,	1
12.,	282.76,	182.56,	1
13.,	277.46,	179.50,	1
14.,	266.85,	185.63,	1
15.,	272.15,	188.69,	1
16.,	272.15,	182.56,	1
17.,	272.15,	188.69,	1
18.,	261.55,	194.81,	1
19.,	208.51,	164.19,	1
20.,	208.51,	139.70,	1
21.,	261.55,	109.08,	1
22.,	277.46,	118.26,	1
23.,	277.46,	167.25,	1
24.,	277.46,	124.39,	1
25.,	282.76,	127.45,	1
26.,	288.06,	124.39,	1
27.,	282.76,	127.45,	1
28.,	282.76,	176.44,	1
29.,	288.06,	173.38,	1
30.,	288.06,	124.39,	1
31.,	288.06,	173.38,	1
32.,	293.37,	176.44,	1
33.,	293.37,	127.45,	1
34.,	288.06,	124.39,	1
35.,	289.14,	116.89,	2
36.,	302.25,	115.10,	1
37.,	299.75,	114.85,	1
38.,	297.25,	112.21,	1
39.,	296.21,	108.72,	1
40.,	297.25,	106.44,	1
41.,	289.14,	116.89,	1
42.,	302.25,	115.10,	1
43.,	303.28,	112.81,	1
44.,	302.54,	110.31,	1

45.,	300.25,	111.63,	1
46.,	299.75,	111.58,	1
47.,	299.25,	111.05,	1
48.,	299.04,	110.36,	1
49.,	299.25,	109.90,	1
50.,	301.54,	108.58,	1
51.,	299.75,	106.68,	1
52.,	297.25,	106.44,	1
53.,	299.75,	106.68,	1
54.,	301.54,	108.58,	1
55.,	306.32,	105.82,	1
56.,	306.82,	105.87,	1
57.,	307.32,	106.39,	1
58.,	307.52,	107.09,	1
59.,	307.32,	107.55,	1
60.,	302.54,	110.31,	1
61.,	307.32,	107.55,	1
62.,	306.82,	107.50,	1
63.,	306.32,	106.97,	1
64.,	306.11,	106.28,	1
65.,	306.32,	105.82,	1
66.,	300.00,	85.00,	2
67.,	300.00,	82.59,	1
68.,	300.00,	80.05,	2
69.,	300.00,	77.59,	1
70.,	300.00,	75.12,	2
71.,	300.00,	72.66,	1
72.,	300.00,	70.19,	2
73.,	300.00,	67.73,	1
74.,	300.00,	65.27,	2
75.,	300.00,	62.80,	1
76.,	300.00,	60.34,	2
77.,	300.00,	57.87,	1
78.,	300.00,	55.48,	2
79.,	300.00,	52.94,	1
80.,	300.00,	50.48,	2
81.,	300.00,	48.09,	1
82.,	300.00,	46.09,	2
83.,	300.00,	45.00,	1
84.,	275.00,	45.00,	1
85.,	305.00,	45.00,	1
86.,	305.00,	85.00,	1
87.,	255.00,	85.00,	1
88.,	255.00,	65.00,	1
89.,	275.00,	65.00,	1
90.,	275.00,	45.00,	1
91.,	275.00,	65.00,	1

92.,	255.00,	65.00,	1
93.,	225.00,	45.00,	2
94.,	220.00,	45.00,	1
95.,	220.00,	47.78,	1
96.,	220.00,	50.55,	2
97.,	220.00,	53.33,	1
98.,	220.00,	56.10,	2
99.,	220.00,	58.87,	1
100.,	220.00,	61.65,	2
101.,	220.00,	64.49,	1
102.,	220.00,	67.19,	2
103.,	220.00,	69.96,	1
104.,	220.00,	72.74,	2
105.,	220.00,	75.51,	1
106.,	220.00,	78.20,	2
107.,	220.00,	80.82,	1
108.,	220.00,	83.21,	2
109.,	220.00,	85.00,	1
110.,	225.00,	85.00,	1
111.,	225.00,	45.00,	1
112.,	195.00,	45.00,	1
113.,	210.00,	45.00,	1
114.,	210.00,	85.00,	1
115.,	220.00,	85.00,	1
116.,	175.00,	85.00,	1
117.,	175.00,	65.00,	1
118.,	195.00,	65.00,	1
119.,	195.00,	45.00,	1
120.,	195.00,	65.00,	1
121.,	175.00,	65.00,	1
122.,	145.00,	45.00,	2
123.,	115.00,	45.00,	1
124.,	130.00,	45.00,	1
125.,	130.00,	85.00,	1
126.,	140.00,	85.00,	1
127.,	140.00,	45.00,	1
128.,	145.00,	45.00,	1
129.,	145.00,	85.00,	1
130.,	95.00,	85.00,	1
131.,	95.00,	65.00,	1
132.,	115.00,	65.00,	1
133.,	115.00,	45.00,	1
134.,	115.00,	65.00,	1
135.,	95.00,	65.00,	1
136.,	65.00,	45.00,	2
137.,	65.00,	85.00,	1
138.,	15.00,	85.00,	1

139.,	15.00,	65.00,	1
140.,	35.00,	65.00,	1
141.,	35.00,	45.00,	1
142.,	65.00,	45.00,	1

APPENDIX L. CAI OPERATING PROCEDURES FOR PC's

Drafting and Design 101

1. Obtain student disk from computer lab supervisor.
2. Place diskette in drive A (top slot) and close lever.
3. Turn the computer on.
 - a. push button on monitor
 - b. toggle switch on back right hand side of computer.
4. Wait about two (2) minutes for computer to load program. (Seems like forever!)
5. Press CAPS lock in lower right hand corner of keyboard when prompted.
6. Type in first name at prompt, then hit return.
7. Type in 4 digit class code number at prompt, then hit return.
8. Type in last 4 digits of social security number at prompt, then hit return.
9. Answer Y (yes) or N (no) if all information is correct. (No return is needed.)
10. After reading the first page of instructions carefully hit the return then continue with the second page of instructions. Press return again.
11. Follow individual instructions from this point on. After entering your answer A, B, C, D, or E press return. The computer will ask Y/N to continue, a Y will take you to the next block.
12. When all 20 items have been completed make a note of your score to give to the lab supervisor, remove the disk, turn the machine off, and return disk to supervisor.

Angled lines will appear to be stepped instead of straight lines.

Anytime you are asked a Y/N question, a return is not required.

The numbers keypad will not work to enter numbers unless you first press the NUMLOCK key.

Please do not remove the disk from the disk drive until the red indicator light on the front has gone off.